DOCUMENT RESUME

ED 221 764 CE 034 185

AUTHOR Hill, Pamela
TITLE Starting System. Teacher's Guide. Small Engine Repair Series. First Edition.
INSTITUTION East Texas State Univ., Commerce. Occupational Curriculum Lab.
SPONS AGENCY Texas Education Agency, Austin. Dept. of Occupational Education and Technology.
PUB DATE 81
NOTE 87p.; For related documents see ED 146 392 and CE 034 181-188.
AVAILABLE FROM Occupational Curriculum Laboratory, East Texas State University, Commerce, TX 75428.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Behavioral Objectives; *Disabilities; *Engines; Industrial Arts; Learning Activities; *Repair; Secondary Education; Teaching Guides; Trade and Industrial Education; Visual Aids
IDENTIFIERS *Ignition Systems; *Small Engine Mechanics

ABSTRACT

This teacher's guide accompanies three student manuals and together with them comprises an instructional package on the starting system in the Small Engine Repair Series for handicapped/special needs students. The first section, "Notes to the Instructor," covers equipment needs, preparation before teaching the instructional package, student evaluation, visual aids, and use of audiovisuals and student manuals. Student prerequisite skills and suggested activities are then listed. Student goal and objectives are arranged to assist the teacher in the development of individual instructional plans. Activities and materials are suggested to help students achieve these objectives. These additional resource materials are then provided to support the various teaching methods: a listing of vocabulary terms, transparency masters, answers to review materials in the student manuals, an evaluation model, and narratives for two audiovisual presentations not available here. A list of references is attached. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED221764

SMALL ENGINE REPAIR SERIES

STARTING SYSTEM

Teacher's Guide

Prepared by Pamela Hill

Published by
Occupational Curriculum Laboratory
East Texas State University
Commerce, Texas 75428

CE 034 185

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

in cooperation with
Texas Education Agency
Occupational Education and Technology
Austin, Texas 78701

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
D Bristow
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

FIRST EDITION
1981

Frances Hyatt
EDITOR

Bob Norsworthy
ART DIRECTOR

Brand names, company names, trademarks, or other identifying symbols appearing in the text are used to clarify and identify and do not constitute a recommendation or endorsement.

ETSU, an Equal Opportunity University, complies with all federal requirements prohibiting discriminatory activities.

TEACHER'S GUIDE FOR STARTING SYSTEM

TABLE OF CONTENTS

PAGE

PREFACE V

ACKNOWLEDGMENTS vii

NOTES TO THE INSTRUCTOR 1

STUDENT PREREQUISITE SKILLS 5

STUDENT GOAL AND OBJECTIVES 7

VOCABULARY TERMS FOR STARTING SYSTEM 11

TRANSPARENCY MASTERS 13

TM-1: Purpose of the Starting System
TM-2: Rope Wind Starter
TM-3: Rope Rewind Starter
TM-4: Wind Up Starter
TM-5: Electric Starter
TM-6: Parts of a Rope Rewind Starter
TMs 7-9: How the Rope Rewind Starter Starts the Engine
TMs 10-20: Safety to Follow
TM-21: Tying a Figure 8 Knot
TM-22: Tools for Check and Replace the Starter Rewind Rope
TMs 23-24: Tools for Repair the Starter Rewind Spring

ANSWERS TO REVIEW MATERIAL IN THINGS FOR YOU TO KNOW 61

EVALUATION MODEL 65

NARRATIVES FOR AUDIOVISUAL PRESENTATIONS 67

Check and Replace the Starter Rewind Rope
Repair the Starter Rewind Spring

REFERENCES 81

PREFACE

STARTING SYSTEM, an instructional package in the Small Engine Repair series, was developed, field-reviewed, and evaluated by vocational industrial teachers who teach handicapped students about repairing small engines. This material was developed as an extension of Comprehensive Small Engine Repair by the Mid-America Vocational Curriculum Consortium, Inc., and we recommend the two be used together.

This project, now in its second year, was initiated in 1979 because it was felt that special needs students enrolled in General Mechanical Repair programs in Texas needed more appropriate instructional materials to aid their learning. The aim of this project has been twofold: (1) To task analyze the typical repair jobs of small engines and then identify the minimum required information, safety, and work habits associated with each repair job; and (2) To present this material in a variety of ways that are consistent with learning styles of special needs students with cognitive dysfunctions--primarily, the mentally retarded and learning disabled.

STARTING SYSTEM is designed with a combination of different media approaches--audio, visual, and hands-on. It is anticipated that this balanced multimedia approach will not only provide an opportunity for students to experience learning from different angles, but will also make learning more interesting and easier. Included in STARTING SYSTEM are the following instructional materials:

Audiovisuals:

1. Check and Replace the Starter Rewind Rope
2. Repair the Starter Rewind Spring

Student Manuals:

Introduction: Things For You To Know
1. Check and Replace the Starter Rewind Rope
2. Repair the Starter Rewind Spring

Teacher's Guide: STARTING SYSTEM

Audiovisuals

The two audiovisual presentations portray typical starter repair jobs that are frequently performed in a small engine repair shop. The presentations are available in both a filmstrip/cassette and slide/cassette style. They are short and concise, with simplified steps of the jobs to hold the interest of the special needs learner.

Designed to be used in both group and individual instruction, the audiovisuals may be used as a class presentation before or after "hands-on" demonstration of the repair job. If repetition is needed in order for a student to learn the steps of a job, the presentation may also be viewed individually without teacher assistance. For the student who is an auditory learner or blind, listening to the cassettes will be an important aid in that student's ability to learn the repair jobs.

Student Manuals

Accompanying STARTING SYSTEM are three student manuals. These contain numerous illustrations and pictures, with written material on a low reading level. Each manual has its own performance objective and evaluation chart so that the students can understand what is expected and rate their own progress toward achieving the objective.

Information in Things For You To Know is given in small, sequential segments so that the students are not overwhelmed with the amount of information to be learned. With the short review sections, titled "How Much Do You Remember?" the students can individually learn the information that is grouped together before going on to the next segment of information.

Material covered in Things For You To Know is considered to be the minimum information that a student needs to know about the starting system in order to get a small engine repair job. However, for those students who are able to learn and retain more information, it is recommended that the teacher refer to the unit on Starting Systems in Comprehensive Small Engine Repair.

Student Manuals 1 and 2 explain in pictures and short sentences the two major repair jobs of starter rewind systems. Among the steps of each repair job, specific safety and caution information is frequently noted throughout the manuals. To reinforce consistency in material presented to the slow learner, the pictures and written words correspond exactly with the pictures and wording on the audiovisual presentations.

The three student manuals may be used in several different ways. They may be used as a picture manual by the student, who can look at the pictures while learning the information or doing the steps of the job; they may be used as reading material to reinforce reading skills; or they may be used by the teacher to help explain information or parts of the job that are difficult to understand or see during hands-on demonstration.

Teacher's Guide

The Teacher's Guide was developed with one thought in mind--to help the teacher provide successful learning experiences for the special needs student. Student prerequisite skills have been identified to give the teacher the option of teaching these skills before or during the presentation of STARTING SYSTEM. Objectives are arranged so that they may help the teacher develop Individual Instructional Plans (IIPs). Additional resource material, such as the vocabulary terms, transparency masters, and audiovisual narratives, are given to support the variety of teaching methods.

STARTING SYSTEM may be purchased as an individual instructional package of the Small Engine Repair series, and additional student manuals may be purchased separately.

For further information or comment on STARTING SYSTEM or the Small Engine Repair series, contact the Occupational Curriculum Laboratory, East Texas State University, Commerce, Texas 75428.

ACKNOWLEDGMENTS

Recognition for the successful development of STARTING SYSTEM is given to the Industrial Employers and Teachers Advisory Committee who conscientiously gave of their knowledge and time. Special thanks is extended to the following advisory members:

Charles Francis	Briggs-Stratton Rep.	Wahlburg-McCreary, Inc. Houston
Don Talley	Talley Auto Parts Co.	Commerce
Bill Gray	Bill's Saw Shop	Greenville
Robert Smith	CVAE-GMR	El Paso ISD
Pedro Ruiz	CVAE-GMR	Big Spring ISD
Carl Green	CVAE-GMR	Weatherford ISD
Thaddeus Curry	VEH-GMR	Klein ISD
Robert Svetlik	CVAE-GMR	Hallettsville ISD
Doyle Melton	CVAE-GMR	Austin ISD
Larry Kilbreth	CVAE-GMR	Pampa ISD
Jesse Swindle	CVAE-GMR	North Lamar ISD
Rex Davis	CVAE-GMR	Newton ISD
Fred Grimm	CVAE-GMR	Belton ISD
Vernon McGee	CVAE-GMR	Goose Creek ISD
Chuck Piggott	CVAE-GMR	Lyeford ISD
William Maroney	CVAE-GMR	Alamo Heights ISD
Ignatius Dugosh	CVAE-GMR	East Central ISD

Appreciation is also given to those General Mechanical Repair instructors who field-reviewed STARTING SYSTEM at area in-service meetings in Texas. Their supportive comments, enthusiasm, and suggestions for changes were most valuable in the completion of this project.

The project staff is also indebted to Dr. Max Plata of the Special Education Department, East Texas State University, who assisted in the development of the format for these instructional materials.

Special appreciation is extended to Tom Hill, Vocational Adjustment Coordinator, Commerce ISD, who arranged for some of the vocational students in his class to serve as models in the audiovisual presentations, and who provided valuable insight for assuring that the final product be as realistic and as job-oriented as possible for special needs students.

Finally, a big "Thanks" to Tracy Lunceford, VAC student, who willingly portrayed the small engine mechanic in the audiovisuals.

NOTES TO THE INSTRUCTOR

EQUIPMENT NEEDED

Before using this presentation, arrange to have the following equipment available:

Projector (either carousel slide or filmstrip type)
Carousel tray, if using slides
Projector screen
Cassette recorder
Overhead projector and other equipment necessary for making transparencies
Tools and small gas engines equipped with rope rewind starters for student use

PREPARATION BEFORE TEACHING THIS INSTRUCTIONAL PACKAGE

Before you begin teaching this instructional package, there are some things you should do:

1. Preview all instructional materials provided (Teacher's Guide, student manuals, and audiovisual presentations). Determine how they will be used in your class.

2. Assess each student for the Student Prerequisite Skills before introducing the instructional package. These prerequisite skills are provided in this guide.

3. Gather additional resources necessary to teach the prerequisite skills to those students who are deficient.

4. Teach the prerequisite skills to those students who need them.

This will help ensure successful learning of STARTING SYSTEM by each student.

STUDENT GOAL AND OBJECTIVES

The student goal and objectives for this instructional package are provided on page 7. These are to assist you in writing each student's Individual Instructional Plan (IIP). The student goal and objectives are also given to the student at the beginning of each student manual. They are titled "The Point of This Booklet" and "What You Will Have to Know and Do." The goal and objectives have been reworded at a level which is understandable to the student.

1. Discuss the goal and objectives with each student so that it is clearly understood what is expected of them.

2. Add any additional objectives such as the prerequisite skills which need to be learned by the student.

NOTE: Some teachers who field-reviewed this material felt that servicing the clutch should also be taught with the repair jobs of STARTING SYSTEM.

EVALUATION CHARTS

It is encouraged that a grading system not be based on a written test, but rather on individual physical performance of the objectives by each student. Evaluation charts are provided at the end of each student manual. The charts are intended for use as grading instruments and as motivational aids by rating personal progress toward the objectives.

1. Discuss with the students how they will be evaluated, based on individual performance shown by the evaluation charts.

2. See the section titled "Evaluation Model" for specific instructions on how to use the evaluation charts.

TRANSPARENCY MASTERS

Numerous 8½" x 10" illustrations have been provided in the Teacher's Guide to be used in a variety of ways:

1. As transparencies. If so, make an acetate of each illustration so that it may be projected onto a screen, using an overhead projector.

2. Copied and used as hand-outs to students.

3. As review activities; i.e., students are asked to identify items on an illustration in which the names of parts have been erased.

4. As display material for a bulletin board.

INTRODUCTION: THINGS FOR YOU TO KNOW

1. Before introducing the two repair jobs of the starting system, first teach the minimum information, safety, and good work habits that are presented.

2. For those students who are able to read and benefit from the activities, provide them with their own manual.

3. Using the transparencies and any additional resource material, teach the information provided in small, sequential steps.

4. Reinforce the learning of this information by having the student complete the activities in the section, "How Much Do You Remember?"

5. Frequently review the information to be learned in short, 15-minute practice sessions that can be spaced throughout other shop activities.

6. Provide for over-learning by giving the student additional reinforcement activities.

7. Make sure the student has mastered previously taught information before introducing new information to be learned.

8. Share with the student's special education teacher Things for You to Know, the transparencies, and the vocabulary terms so that this informations can be reinforced with the student.

AUDIOVISUALS AND STUDENT MANUALS 1 AND 2

1. When introducing each of the repair jobs of the starting system, use a combination of teacher demonstration, viewing of the audiovisual presentation, and student hands-on experience with an engine which is equipped with a rope rewind starter.

2. Present the steps to each repair job in small, sequenced amounts so that each step is mastered by the student.

3. Have the student who needs additional help view the audiovisual presentation while doing each step of the job on an engine. This can be accomplished by having the student manually advancing the cassette and projector once a previously viewed step has been completed by the student on an engine.

4. For those students who are visual learners or able to read on a 3.5 grade reading level, provide them with their own Student Manuals 1 and 2.

5. As the repair jobs are taught and the students practice learning the steps, have the students rate their progress using the evaluation charts found in the back of the student manuals.

6. Share with the student's special education teacher Student Manuals 1 and 2 as reading reinforcement materials to be used by the student.

STUDENT PREREQUISITE SKILLS

Listed below are prerequisite skills the student needs in order to successfully learn repair jobs on the rope rewind starter. It is recommended that the instructor teach these skills before or during the student learning of this instructional package.

PREREQUISITE SKILLS	SUGGESTED ACTIVITIES
1. Demonstrates a working knowledge of commonly used vocabulary terms associated with small gas engines.	Discuss "Vocabulary Terms" provided in the Teacher's Guide; use the "Vocabulary Terms" as a transparency and student handout; provide student drills on the terms, and other teacher-made reinforcement activities.
2. Demonstrates proper use and safety of the following tools: 7/16" combination wrench socket set needle nose pliers diagonal cutting pliers vise C-clamp matches thin wire starter rope safety glasses flat tip screwdriver cleaning fluid multi-purpose grease	Use Transparency Masters 22-24, selected TMs 10-19: "Safety to Follow," and any additional resource material on tools.
3. Matches correct sockets with the spark plug and bolts on the shroud.	Provide student with socket set and can of nuts and bolts, and instruct student to find matching pairs. (This gives practice in matching sizes.)
4. Determines whether bolts have a right- or left-hand thread. Correctly threads bolts, and then turns the socket in the correct direction to remove and replace them.	Instruct student to never use a torque wrench on nuts and bolts. Provide student with socket set and bolts mounted on a board.
5. Selects the correct type, width, and length of a new starter rewind rope for an engine.	Practice identifying rope specification in the Engine Instruction Manual with specifications on purchased ropes.

PREREQUISITE SKILLS	SUGGESTED ACTIVITIES
6. Ties a simple knot at end of starter rope.	Demonstrate tying a knot and have students practice with a used starter rope.
7. Ties a figure 8 knot at end of starter rope.	Use Transparency Master 20: Tying a Figure 8 Knot, demonstrate and have students practice on old starter rope.
8. Adjusts the throttle, and starts the engine.	Demonstrate and have students practice adjusting the throttle.

STUDENT GOAL AND OBJECTIVES

The following are provided to assist in the development and writing of each student's Individual Instructional Plan (IIP). Built into these objectives is the use of the evaluation charts found at the end of each student manual. You will want to use these charts for monitoring each student's progress toward these objectives. Criterion for competency or the rating that a student must achieve for a pre-determined length of time is suggested as a rating of 3 for three consecutive days on the evaluation charts. See "Evaluation Model," page 65, for further information.

LONG-TERM GOAL: After completing STARTING SYSTEM, the student will be able to identify starter information and demonstrate safety, good work habits, and 2 repair jobs on a rope rewind starter of a small gas engine which are necessary for employment as a small engine mechanic.

SHORT-TERM OBJECTIVES

1. Given information about the starting system of small gas engines, the student will understand and explain the following information for three consecutive days:
   - Tell the purpose of the starting system.
   - Identify the 4 types of small gas engine starters.
   - Name and find the parts of the rope rewind starter.
   - Tell what the parts of the rope rewind starter do.
   - Tell how the rope rewind starter starts the engine.

ACTIVITIES AND MATERIALS

1. Read or listen to information on the starting system, pages 3-20, Things For You To Know.
2. Using transparency masters 1-9, Teacher's Guide, and 4 types of starters on small gas engines, participate in class discussions and drills on the information to be learned.
3. Answer the review questions on "How Much Do You Remember?" pages 4, 10, 16 and 22, Things For You To Know.
4. Using the chart, "What Do You Know About the Starting System?" pages 23-24, Things For You To Know, rate the student progress for two consecutive weeks or until a rating of 3 for three consecutive days is achieved.

NOTE TO THE TEACHER: Teach each of the above subobjectives separately. Evaluate the student's ability to understand and explain the subobjective before introducing the next one.

SHORT-TERM OBJECTIVES	ACTIVITIES AND MATERIALS
2. Given information on safety and good work habits to follow, the student will demonstrate them most of the time for three consecutive days while doing repair jobs on the starting system.	1. Read or listen to information on "Safety to Follow" and "Good Work Habits to Follow," pages 25 and 40, Things For You To Know. 2. Using the transparency masters 10-19, Teacher's Guide, participate in class discussion on the importance of following the safety and good work habits. 3. Answer the review questions on "How Much Do You Remember?" pages 35 and 42, Things For You To Know. 4. Using the chart, "Can You Follow Safety and Good Work Habits?" page 46, Things For You To Know, rate the student progress for two consecutive weeks or until a rating of 3 for three consecutive days is achieved.
3. Given a small gas engine with a rope rewind starter and the correct tools, the student will check and replace the starter rewind rope by correctly following all the steps without help for three consecutive days.	1. Observe the teacher checking and replacing the starter rewind rope on a small gas engine. 2. Watch the audiovisual presentation, "Check and Replace the Starter Rewind Rope," and participate in class discussions on this job. 3. Using Student Manual 1, read the words or follow the pictures which describe the steps in checking and replacing the starter rewind rope. 4. Using a rope rewind starter on a small gas engine and the correct tools, practice the steps in checking and replacing the starter rewind rope.

SHORT-TERM OBJECTIVES	ACTIVITIES AND MATERIALS
	5. Using the chart, "Can You Check and Replace the Starter Rewind Rope?" page 24, Student Manual 1, rate the student progress for two consecutive weeks. 6. Repeat above activities (1 through 5) until a rating of 3 on the chart, "Can You Check and Replace the Starter Rewind Rope?" is achieved for three consecutive days.
4. Given a small gas engine with a rope rewind starter and the correct tools, the student will repair the starter rewind spring by correctly following all the steps without help for three consecutive days.	1. Observe the teacher repairing the starter rewind spring on a small gas engine. 2. Watch the audiovisual presentation, "Repair the Starter Rewind Spring," and participate in class discussions on this job. 3. Using Student Manual 2, read the words or follow the pictures which describe the steps in repairing the starter rewind spring. 4. Using a rope rewind starter on a small gas engine and the correct tools, practice the steps in repairing the starter rewind spring. 5. Using the chart "Can You Repair the Starter Rewind Spring?" page 26, Student Manual 2, rate the student progress for two consecutive weeks. 6. Repeat above activities (1 through 5) until a rating of 3 on the chart, "Can You Repair the Starter Rewind Spring?" is achieved for three consecutive days.

VOCABULARY TERMS FOR STARTING SYSTEM

The following vocabulary terms are words that are frequently found throughout this instructional package. These terms and their definitions are provided to aid the student in developing a common language that is often used in the small engine repair classroom.

1. Adjust--move a part of the engine to help make the engine start and run correctly. When you adjust the throttle cable or choke, you push it back and forth to either open or close the choke which lets fuel and air mixture into the cylinder.

2. Caution--a warning that you should pay attention to and follow or you may break a part of the engine or the tool you are working with.

3. Check--look at something to see if it is broken.

4. Choke--a part of the engine that controls the amount of air going into the combustion chamber for starting the engine.

5. Clutch--a part of the engine that connects the starter with the crankshaft.

6. Combustion chamber--a small area at the top of the cylinder. Fuel mixture is pushed by the piston into the combustion chamber, where it then ignites.

7. Crank (as in "crank the engine")--a quick pull of the starter rope to start the engine.

8. Crankcase--housing for the lubricating oil and most of the engine's moving parts like the crankshaft.

9. Crankshaft--the main shaft of the engine that is connected to the starter pulley and piston. The crankshaft changes the up and down movement made by the piston into circular or rotating movement needed to turn the blades on a lawnmower.

10. Cylinder--a hollow tube inside an engine where the piston moves up and down and the fuel mixture ignites, making inside power which starts the engine.

11. Flywheel--a part of the starting system that forces air around the engine. It looks like a wheel and has fins on it to make the air move around the engine to help keep it from getting too hot.

12. Frayed (as in "frayed rope")--worn and cut places on a rope that have rubbed on the pulley.

13. Fuel mixture--a mixture of gasoline and air that burns in the cylinder of an engine.

14. Grasp--to hold onto something tight enough with your hand so that you don't drop it.

15. Guide lug--a small piece of metal found on the inside of an old-style pulley. When putting the starter rope back onto the pulley, the guide lug helps direct the rope through the starter housing and pulley holes.

16. Ignite--to cause the fuel mixture to burn.

17. Inside power--power made inside the engine, like the up and down movement made by the piston, and circular or rotating movement made by the crankshaft to turn the lawnmower blades.

18. Outside power--power made outside the engine by man; like a hand pulling on a starter rope.

19. Piston--a metal part of the engine that fits into the cylinder. The piston compresses the fuel mixture into the combustion chamber where the fuel mixture ignites. This makes inside power to keep the piston moving up and down in the cylinder.

20. Remove--to take out or take off of the engine.

21. Repair--to take out a worn or broken part of the engine, fix it, and put it back in the engine.

22. Replace--a. to take out a worn or broken part of the engine and put in a new part. b. also put back an engine part that was never worn or broken.

23. Safety tip--a warning that you should pay attention to and follow or you may get hurt.

24. Shroud--the cover over the flywheel that directs air around the engine. The parts of the shroud are the starter housing, starter, and blower housing.

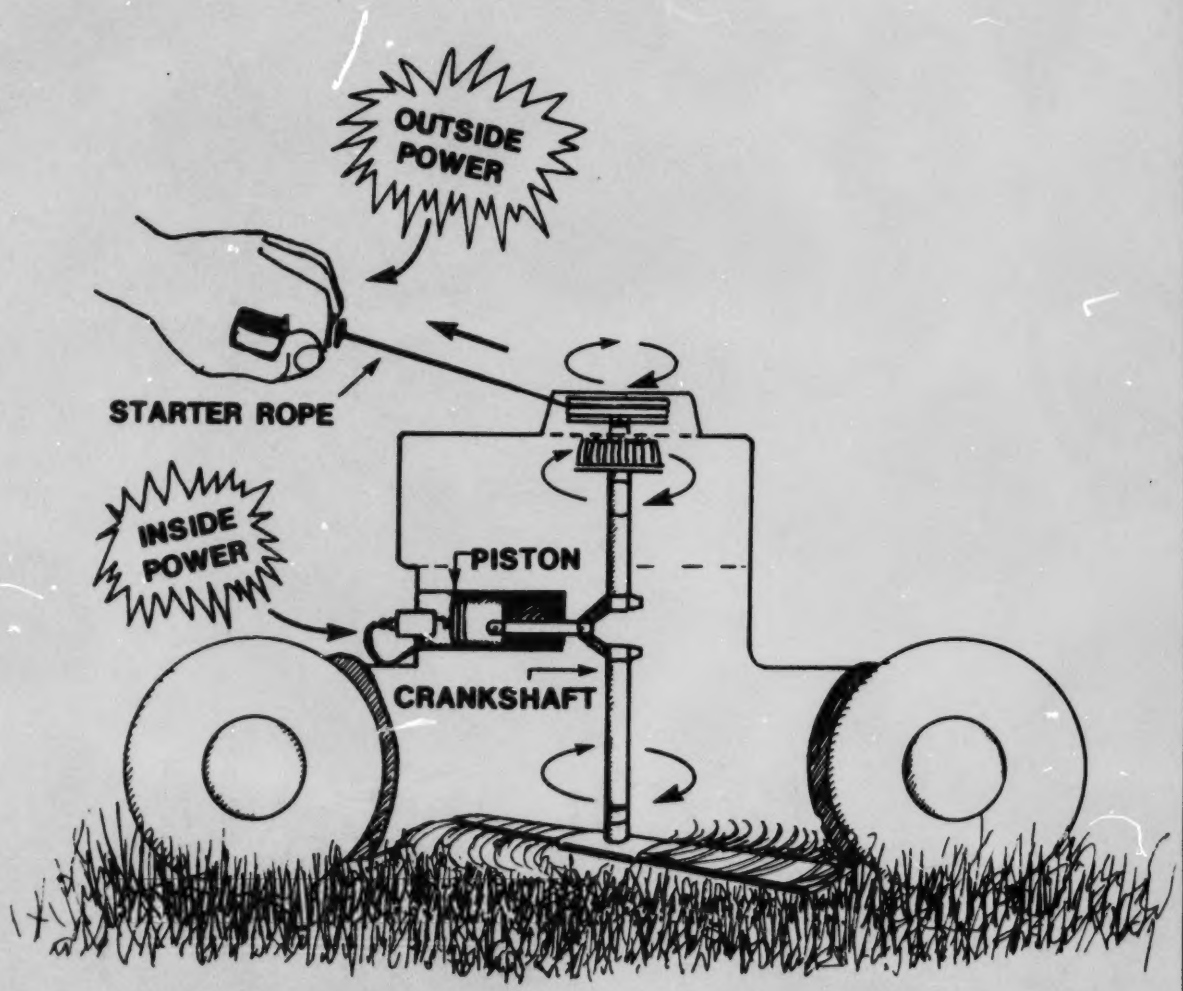
25. Spark plug--a part of the engine that provides a gap for electricity to jump producing a spark of fire to ignite the fuel mixture in the combustion chamber.

26. Starter--a part of the engine that helps to change outside power into inside power.

27. Throttle--a part of the engine that controls the amount of fuel mixture going into the cylinder.

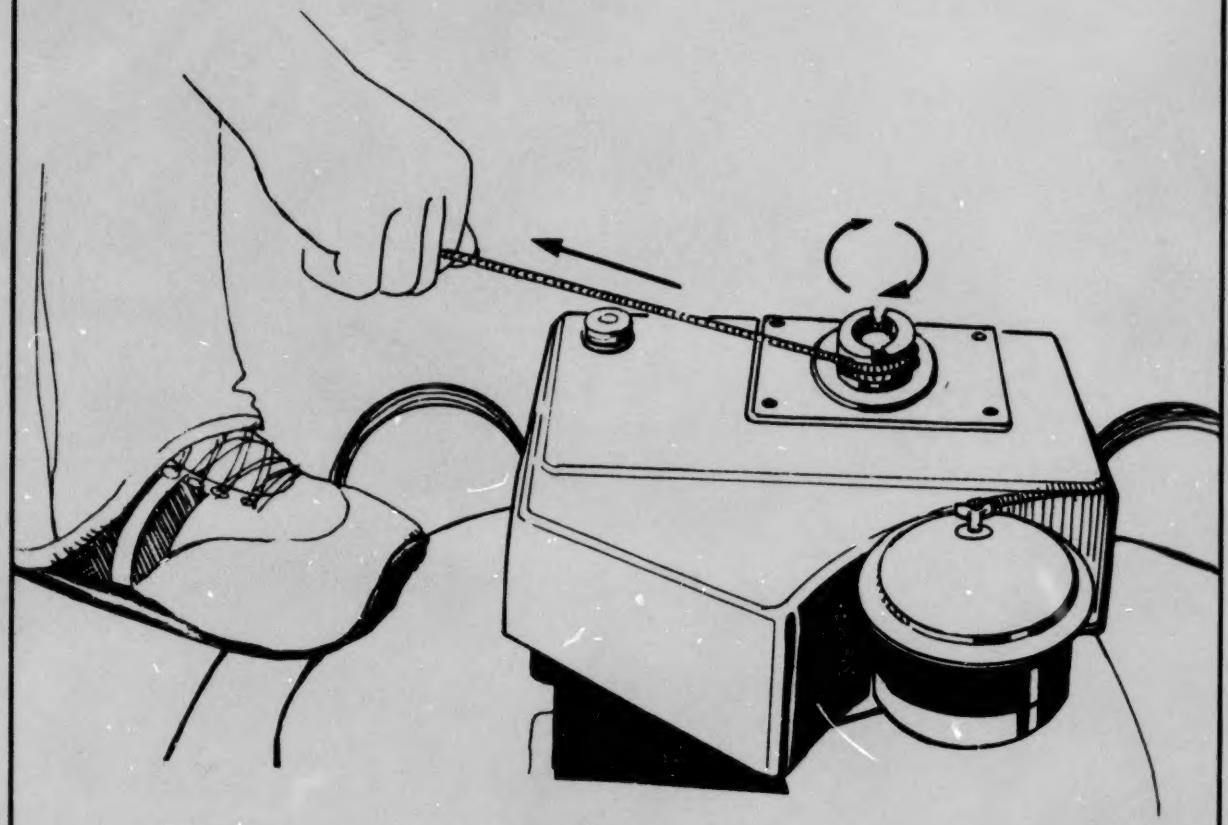
28. Throttle cable--a part of the engine that controls the speed or power of the engine. It is connected to the throttle.

PURPOSE OF THE STARTING SYSTEM

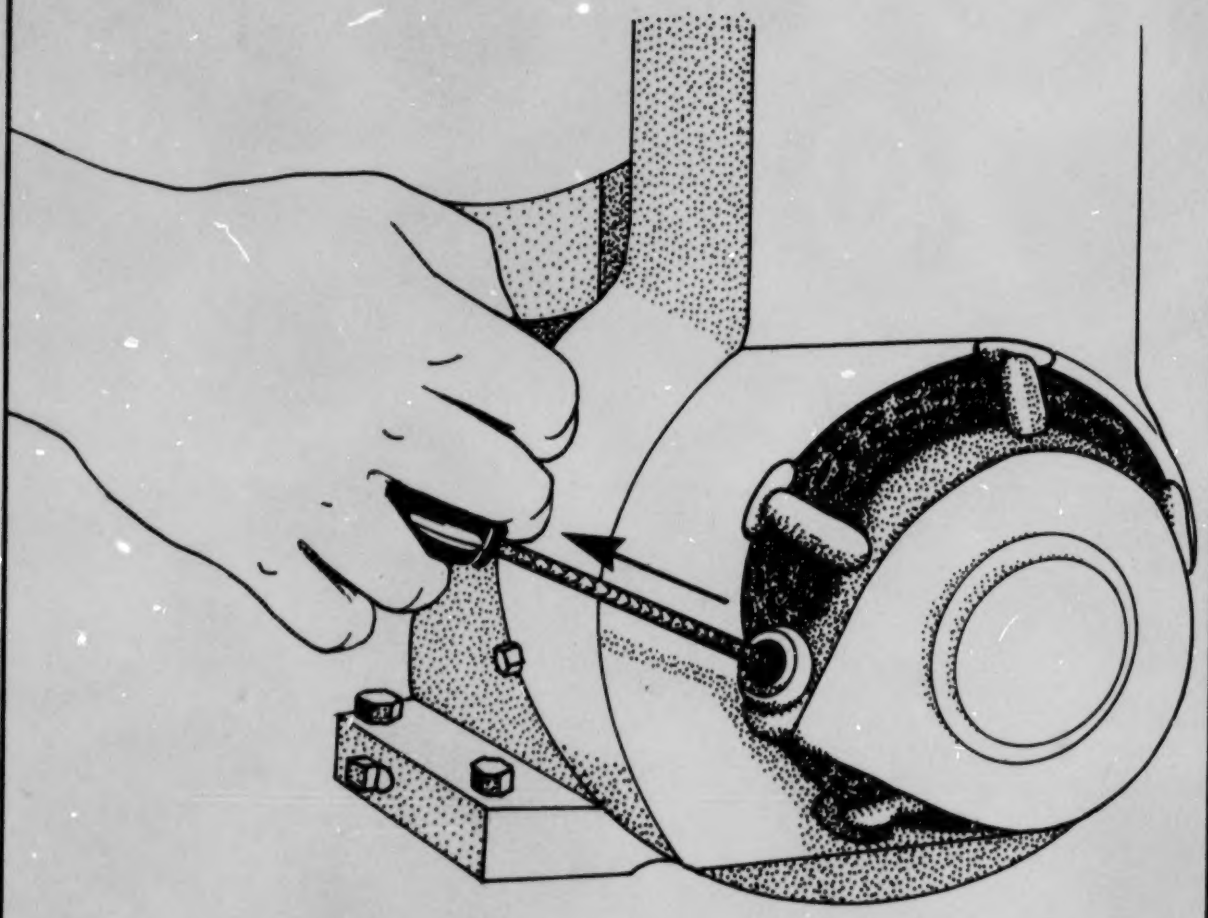


A WAY TO GIVE THE ENGINE ENOUGH OUTSIDE POWER TO TURN THE CRANKSHAFT UNTIL THE FUEL MIXTURE IGNITES AND LETS THE INSIDE POWER FROM THE BURNING FUEL START THE ENGINE.

ROPE WIND STARTER

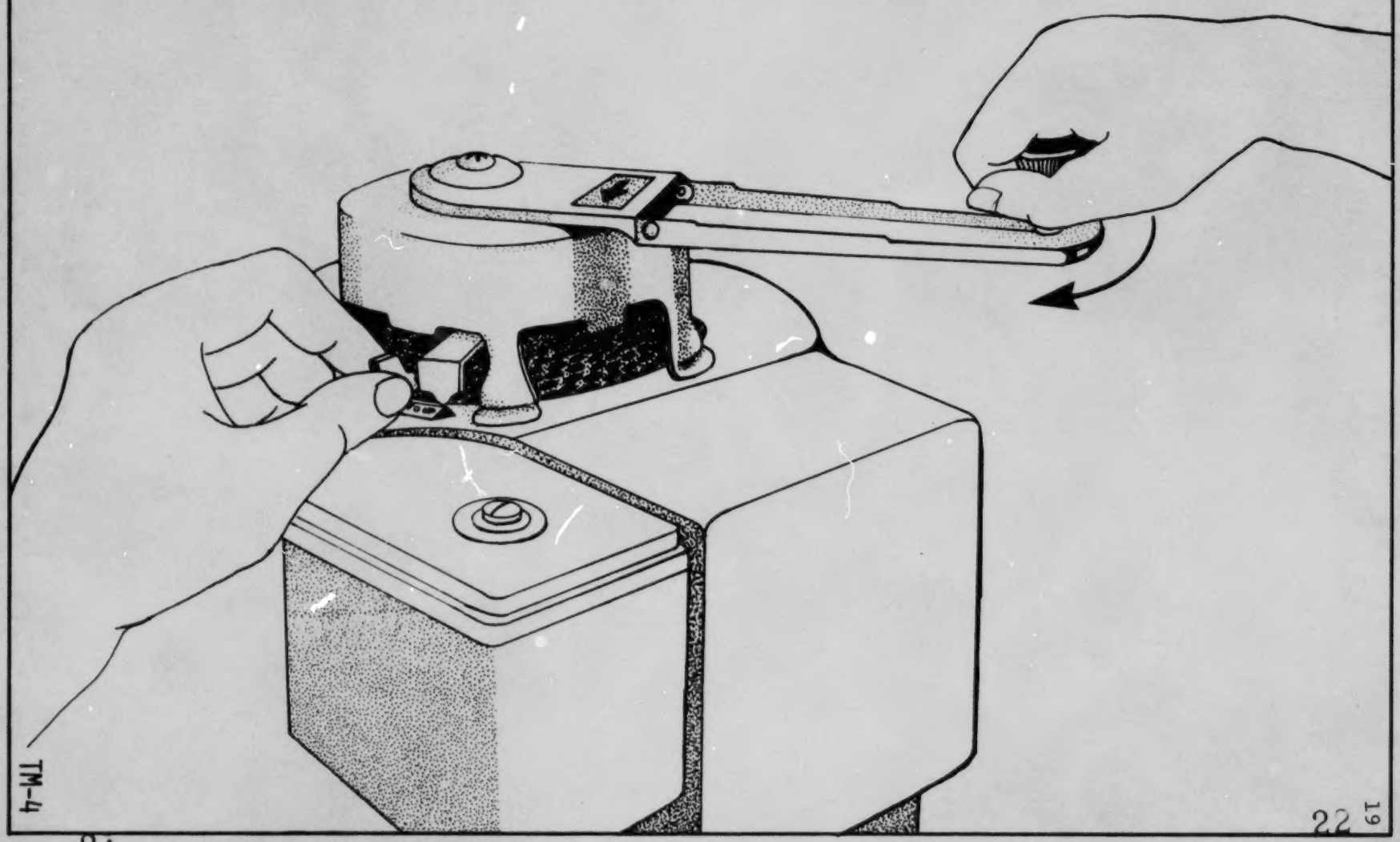


ROPE REWIND STARTER



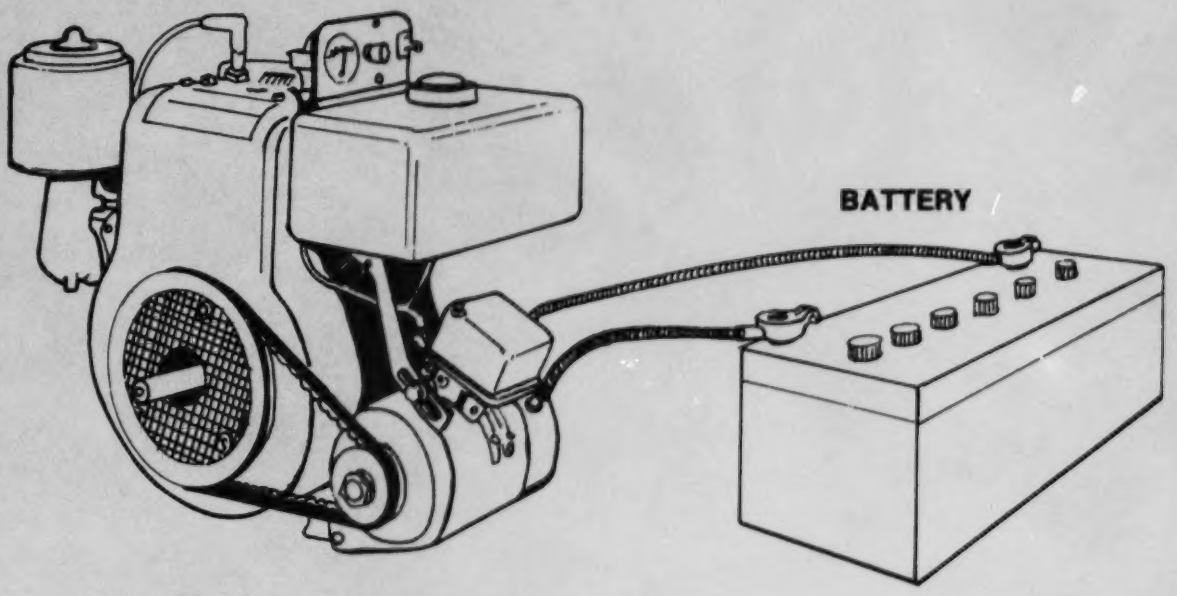
TM-3

WIND-UP STARTER

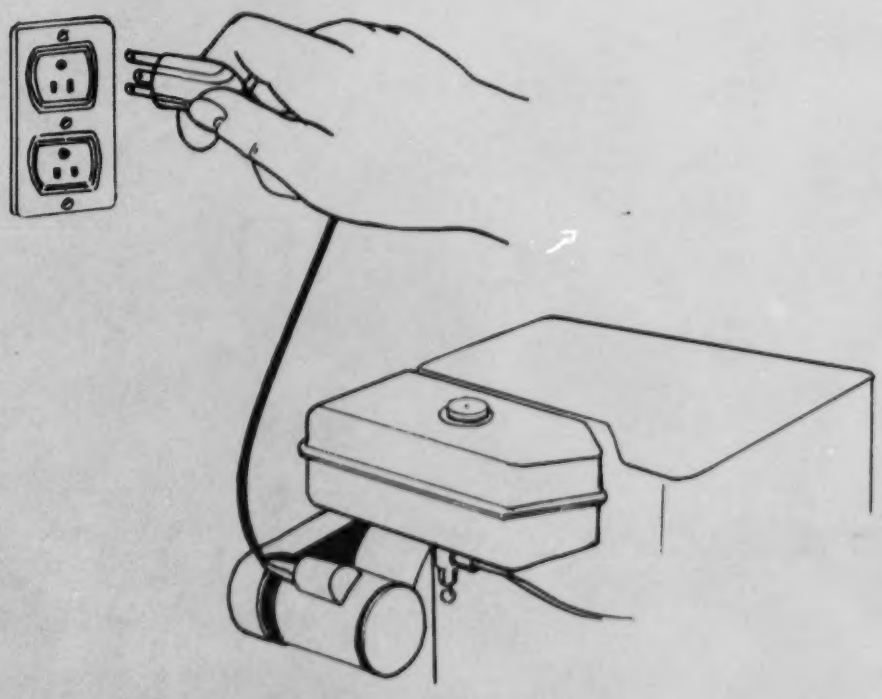


TM-4

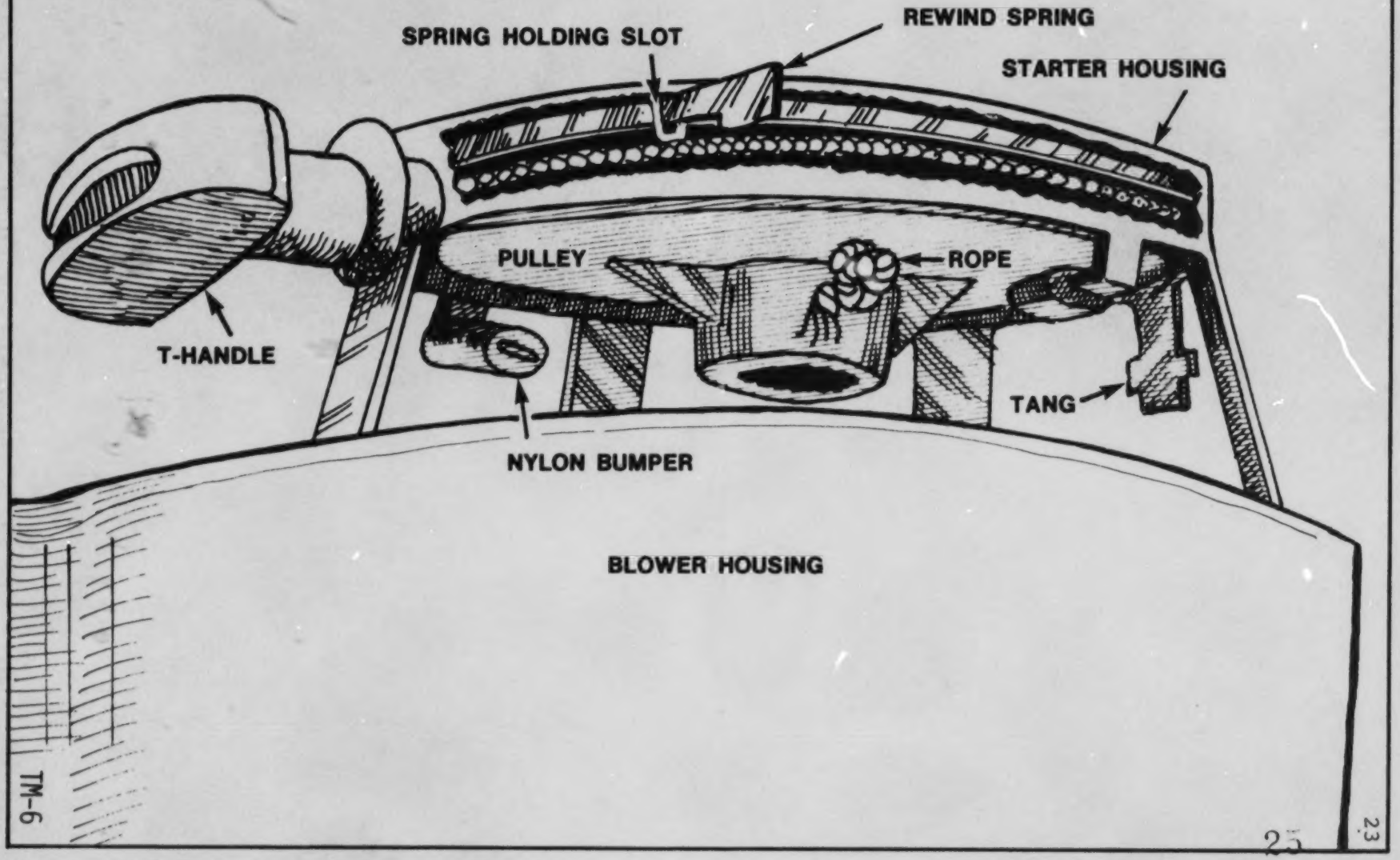
ELECTRIC STARTER



ELECTRICAL OUTLET



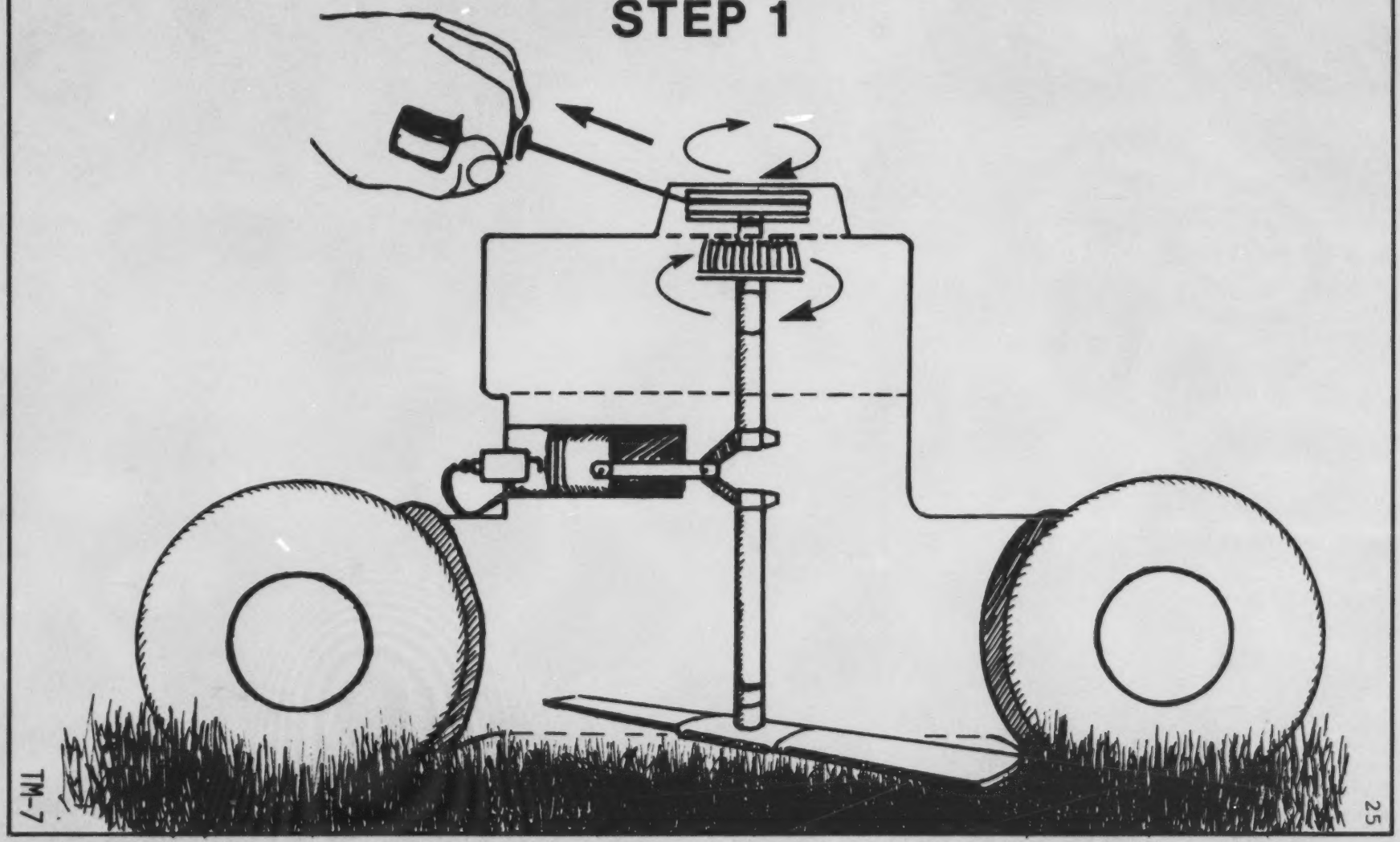
PARTS OF A ROPE REWIND STARTER



TM-6

23

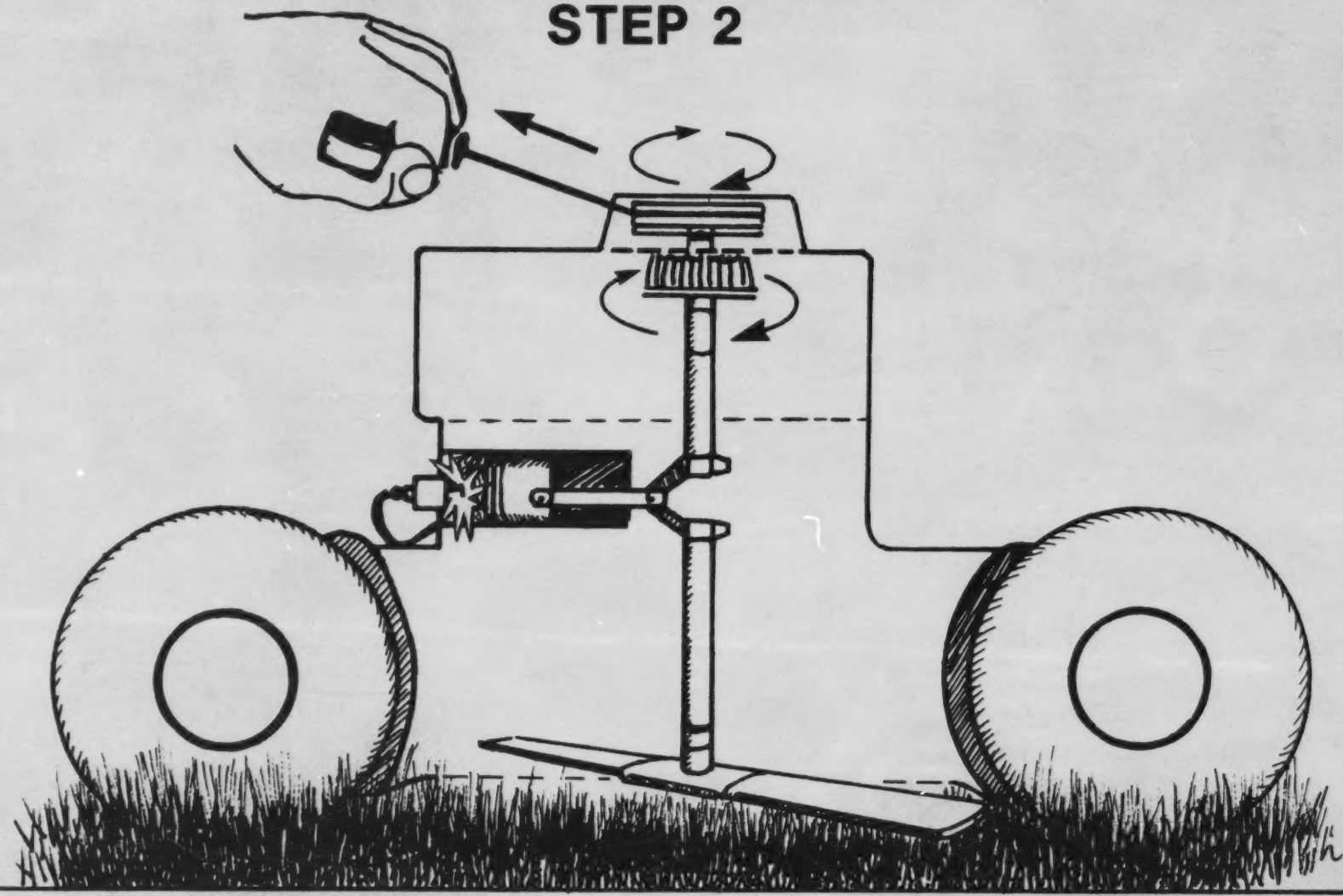
HOW THE ROPE REWIND STARTER STARTS THE ENGINE
STEP 1



TM-7

25

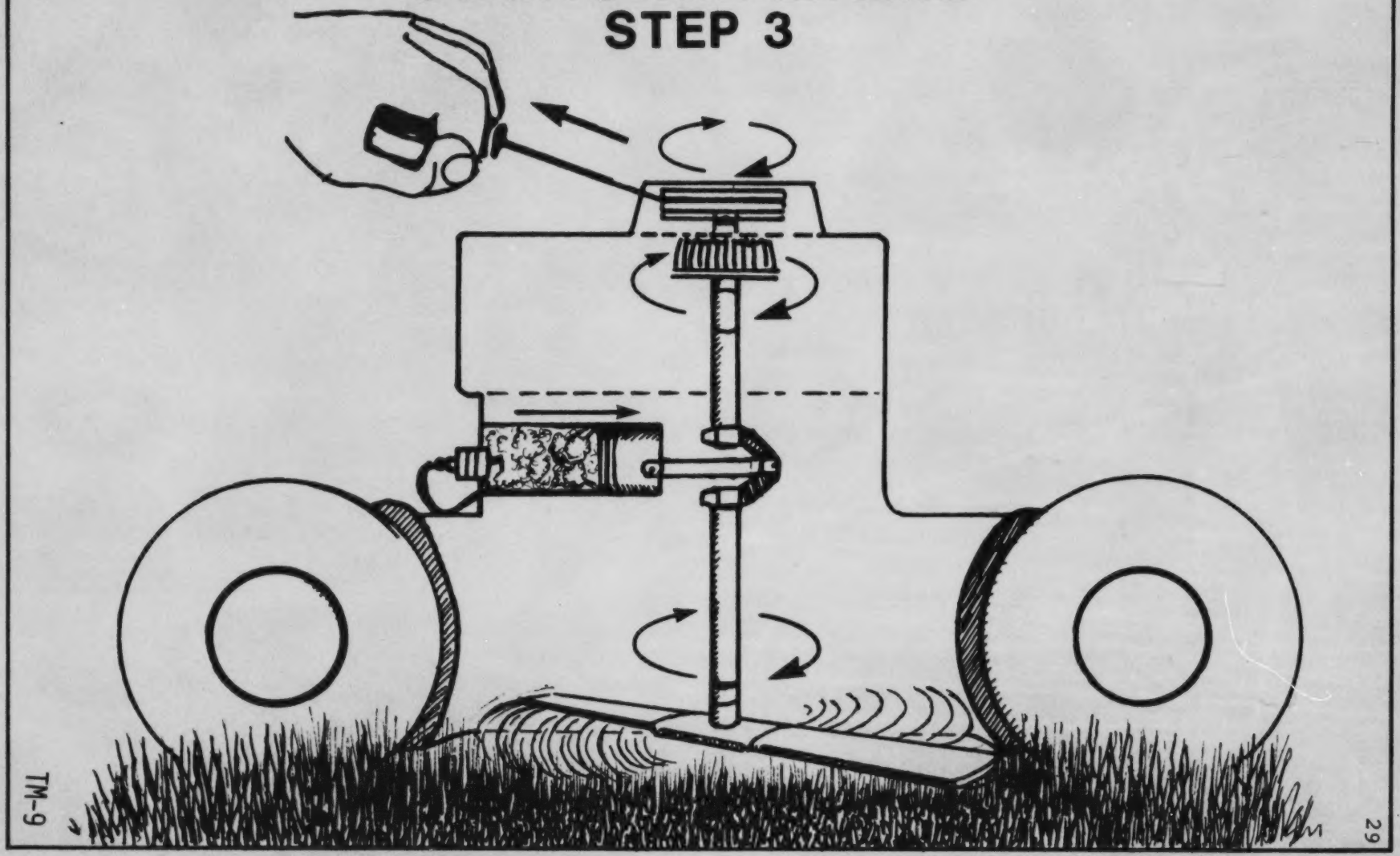
HOW THE ROPE REWIND STARTER STARTS THE ENGINE
STEP 2



TM-8

27

HOW THE ROPE REWIND STARTER STARTS THE ENGINE
STEP 3

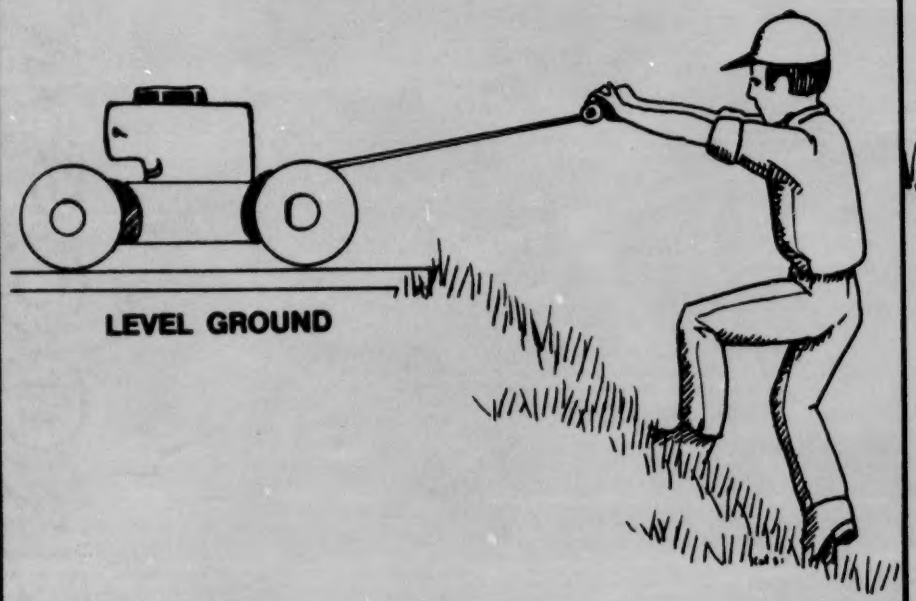


TM-9

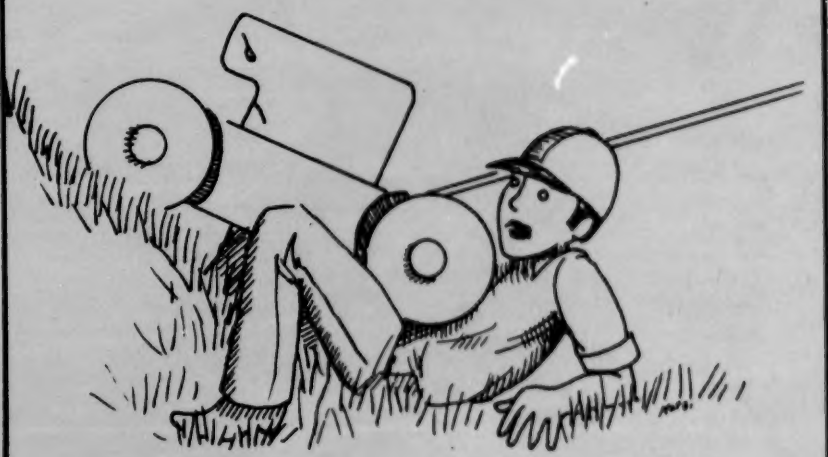
29

SAFETY TO FOLLOW

YES



NO



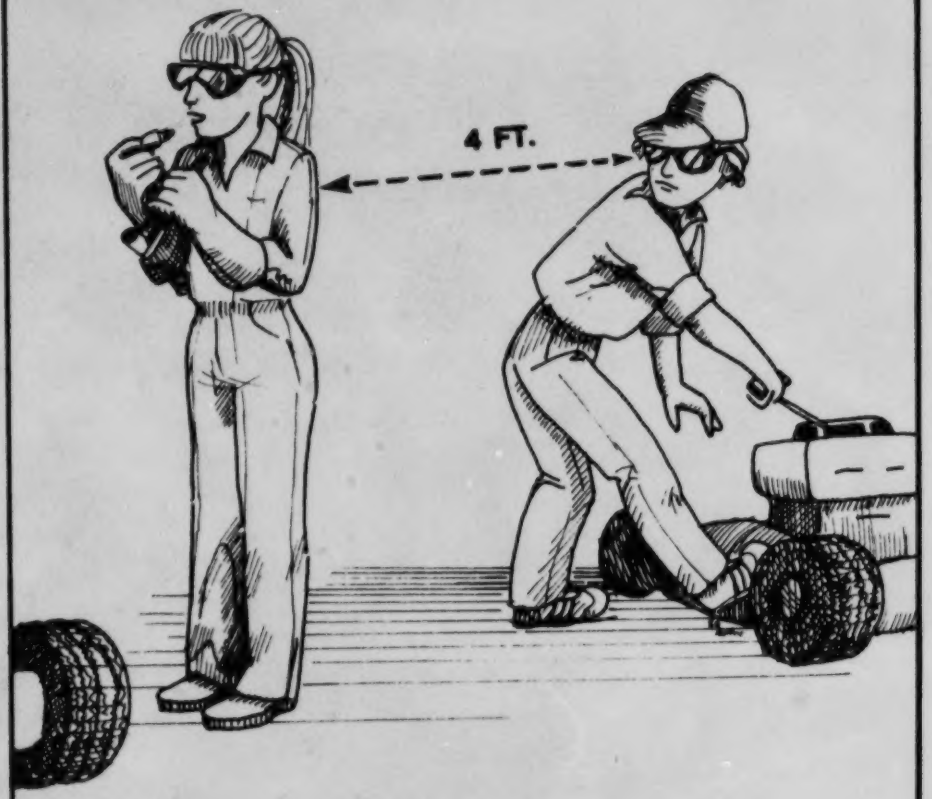
BEFORE STARTING THE ENGINE, SEE THAT IT IS ON LEVEL GROUND.

TM-10

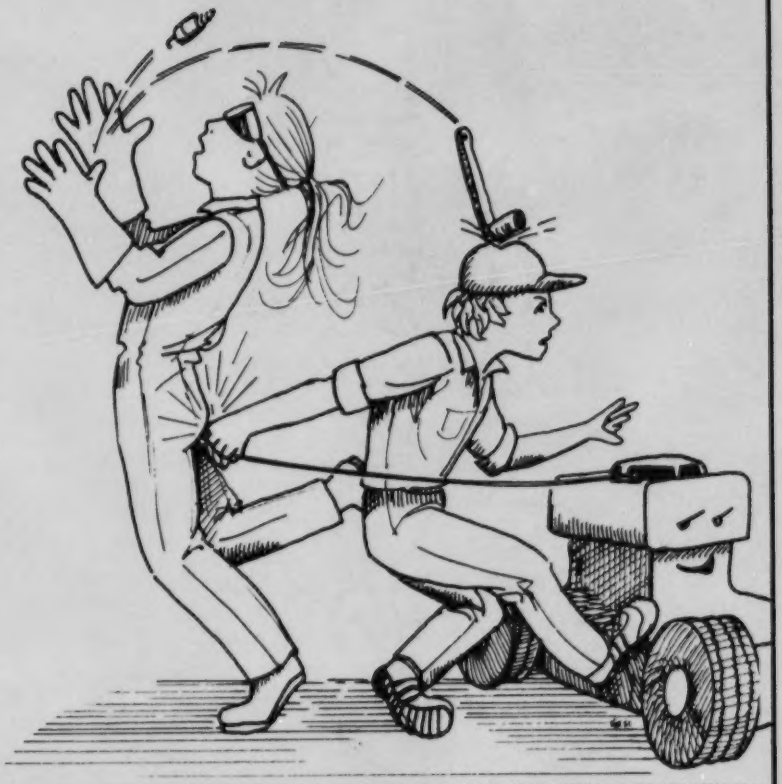
31

SAFETY TO FOLLOW

YES



NO



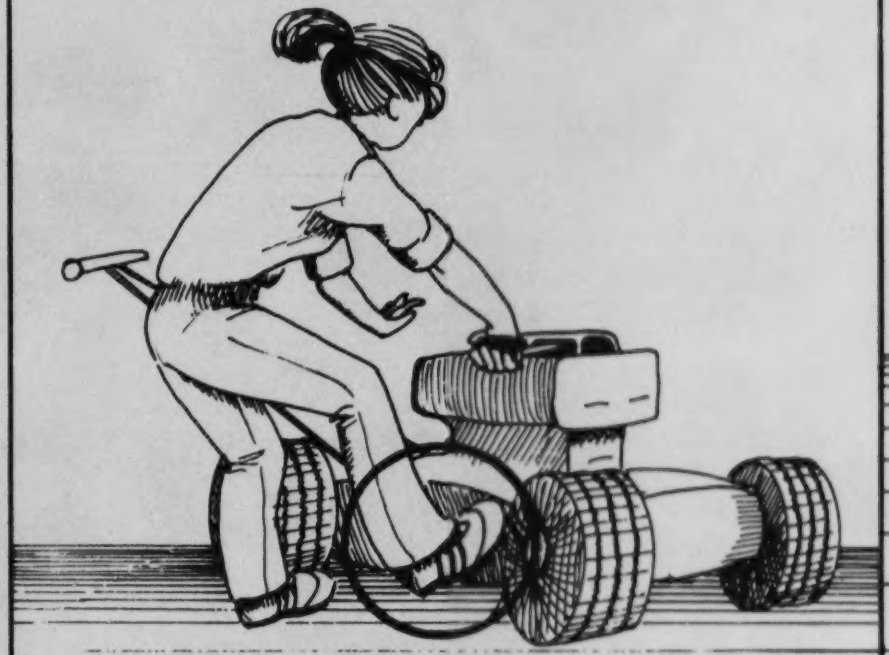
TM-11

LOOK BEHIND YOU BEFORE PULLING THE STARTER ROPE.

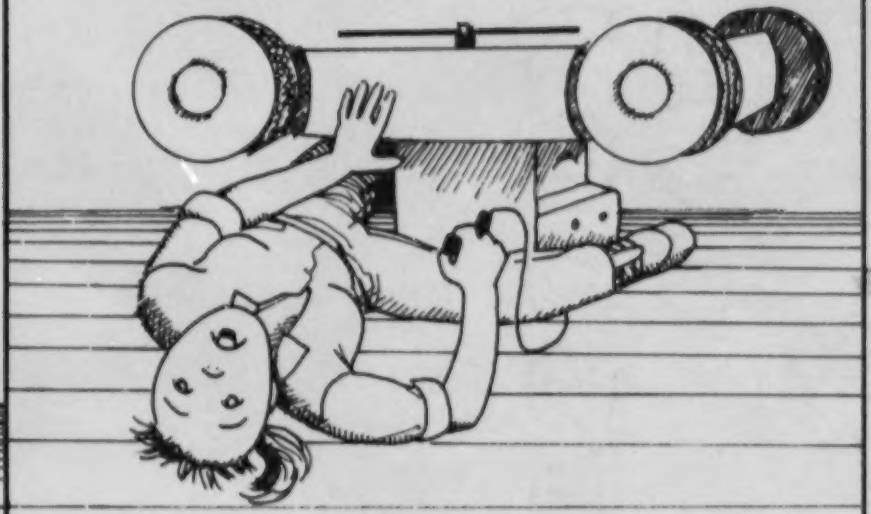
33

SAFETY TO FOLLOW

YES



NO



TM-12

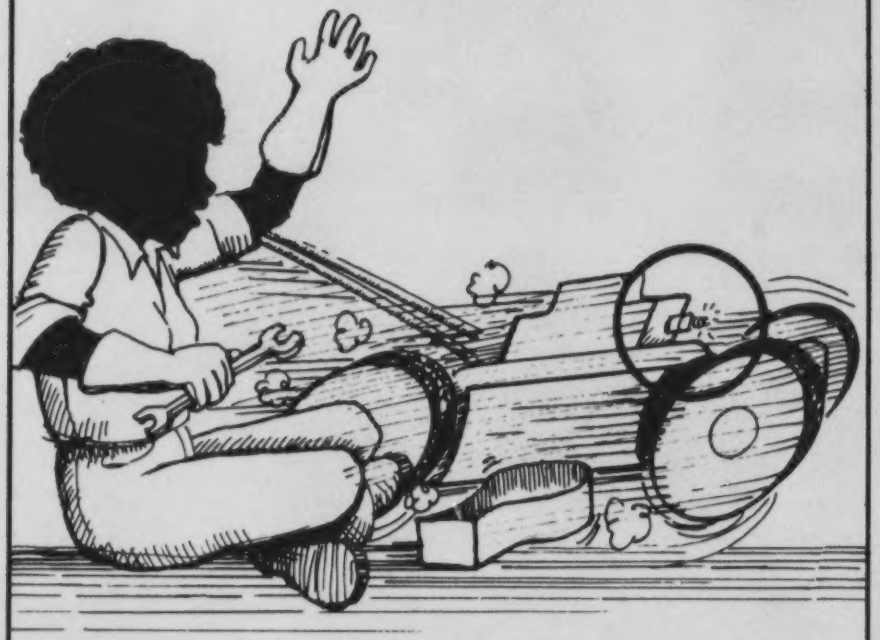
PUT ONE FOOT ON LAWNMOWER WHEN CRANKING THE ENGINE.

35

SAFETY TO FOLLOW

YES

NO



TM-13

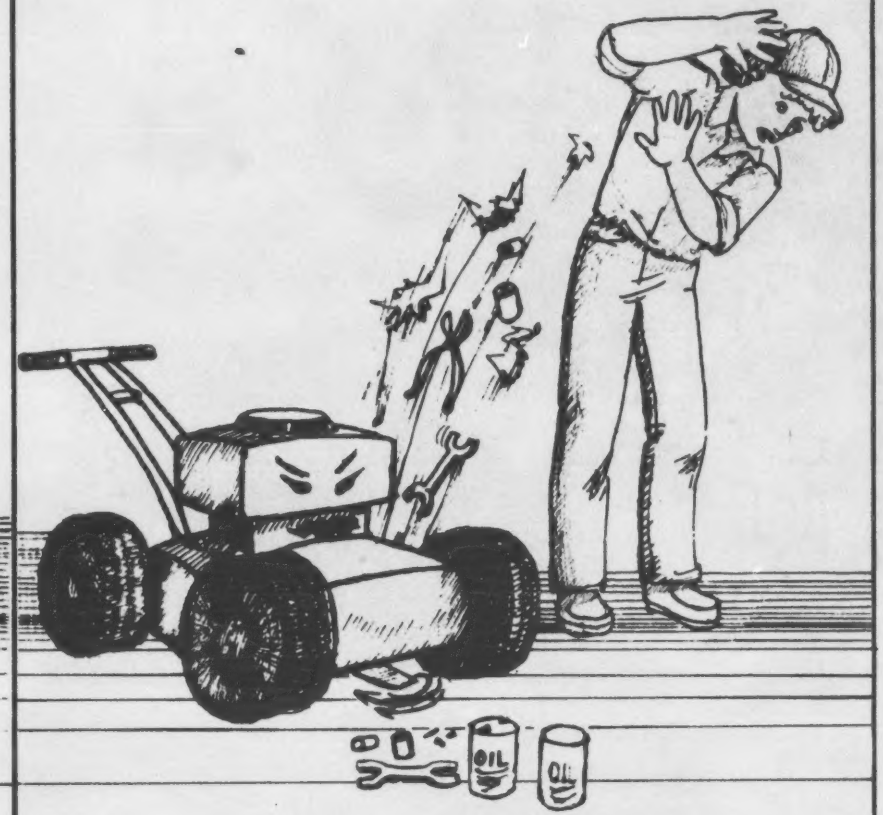
ALWAYS REMOVE THE SPARK PLUG BEFORE WORKING ON AN ENGINE.

37

SAFETY TO FOLLOW

YES

NO



TM-14

WHEN AN ENGINE IS RUNNING, KEEP TOOLS AWAY FROM MOVING PARTS.

39

SAFETY TO FOLLOW

YES

NO

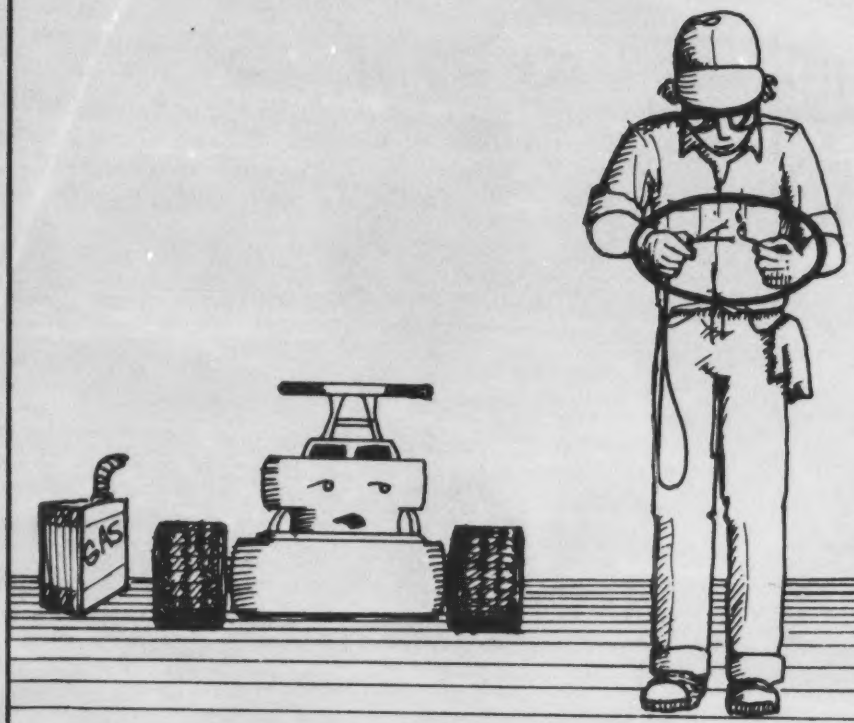
WHEN PLACING THE SHROUD IN A VISE, BE CAREFUL NOT TO OVERTIGHTEN IT.

TM-15

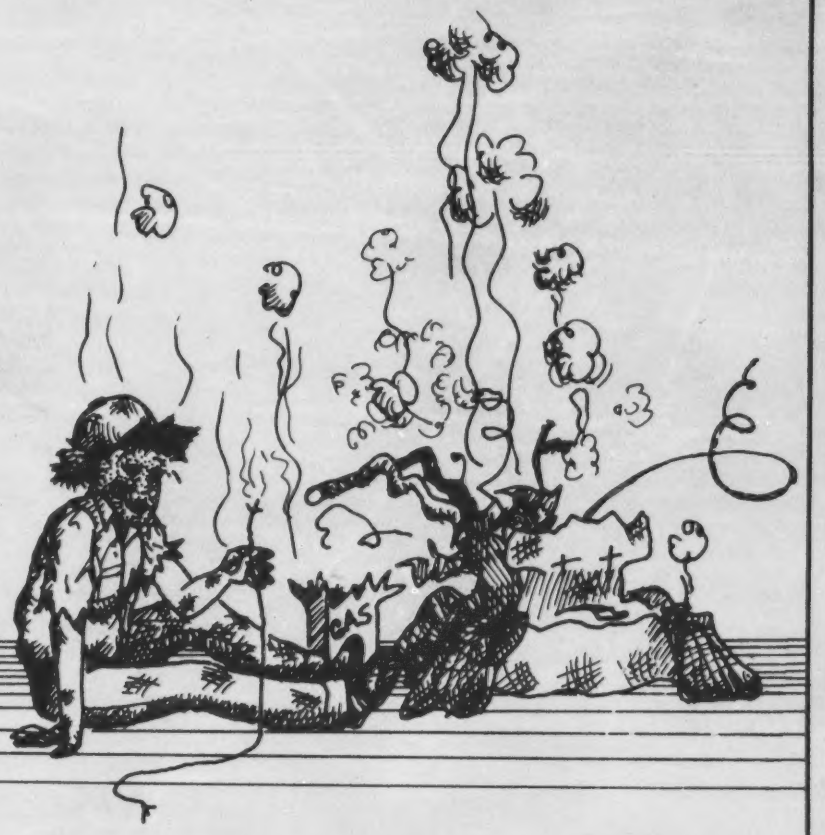
41

SAFETY TO FOLLOW

YES



NO



TM-16

LIGHT MATCHES AWAY FROM GASOLINE AND ENGINE.

43

SAFETY TO FOLLOW

YES

NO

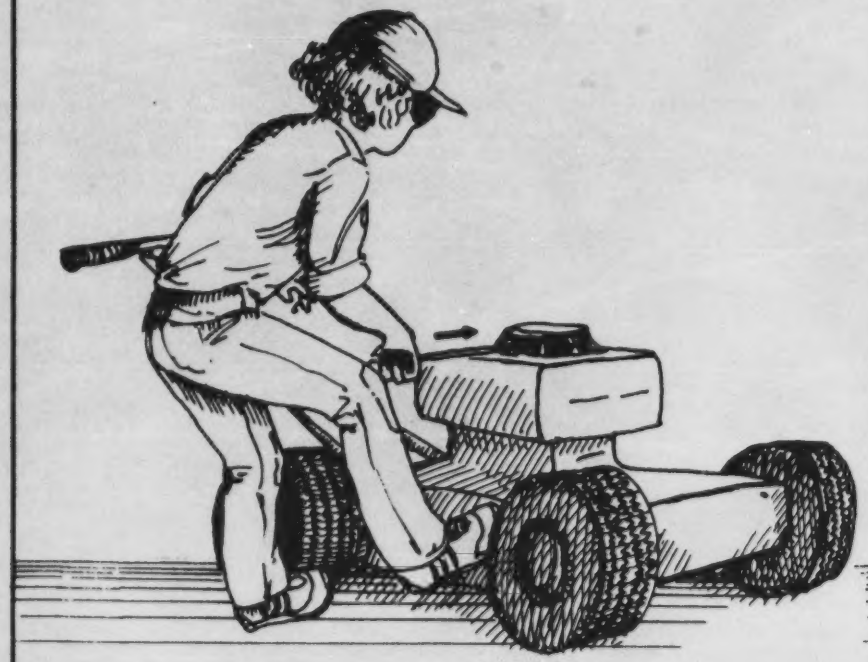
DON'T TOUCH ROPE ENDS UNTIL THEY HAVE COOLED

TM-17

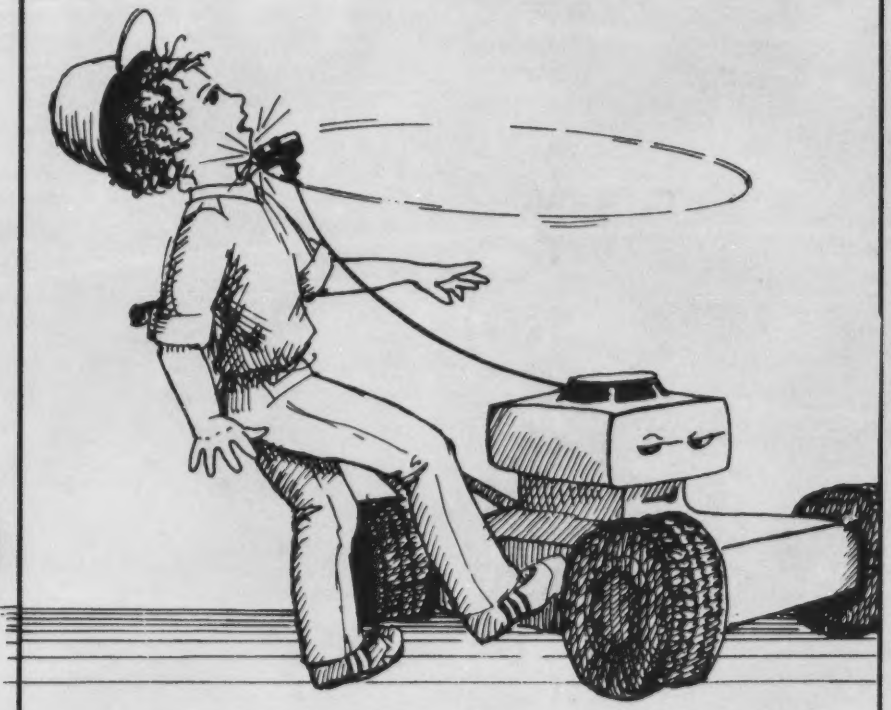
45

SAFETY TO FOLLOW

YES



NO



TM-18

HOLD ON TO ROPE WHEN IT IS REWINDING INTO PULLEY.

47

SAFETY TO FOLLOW

YES

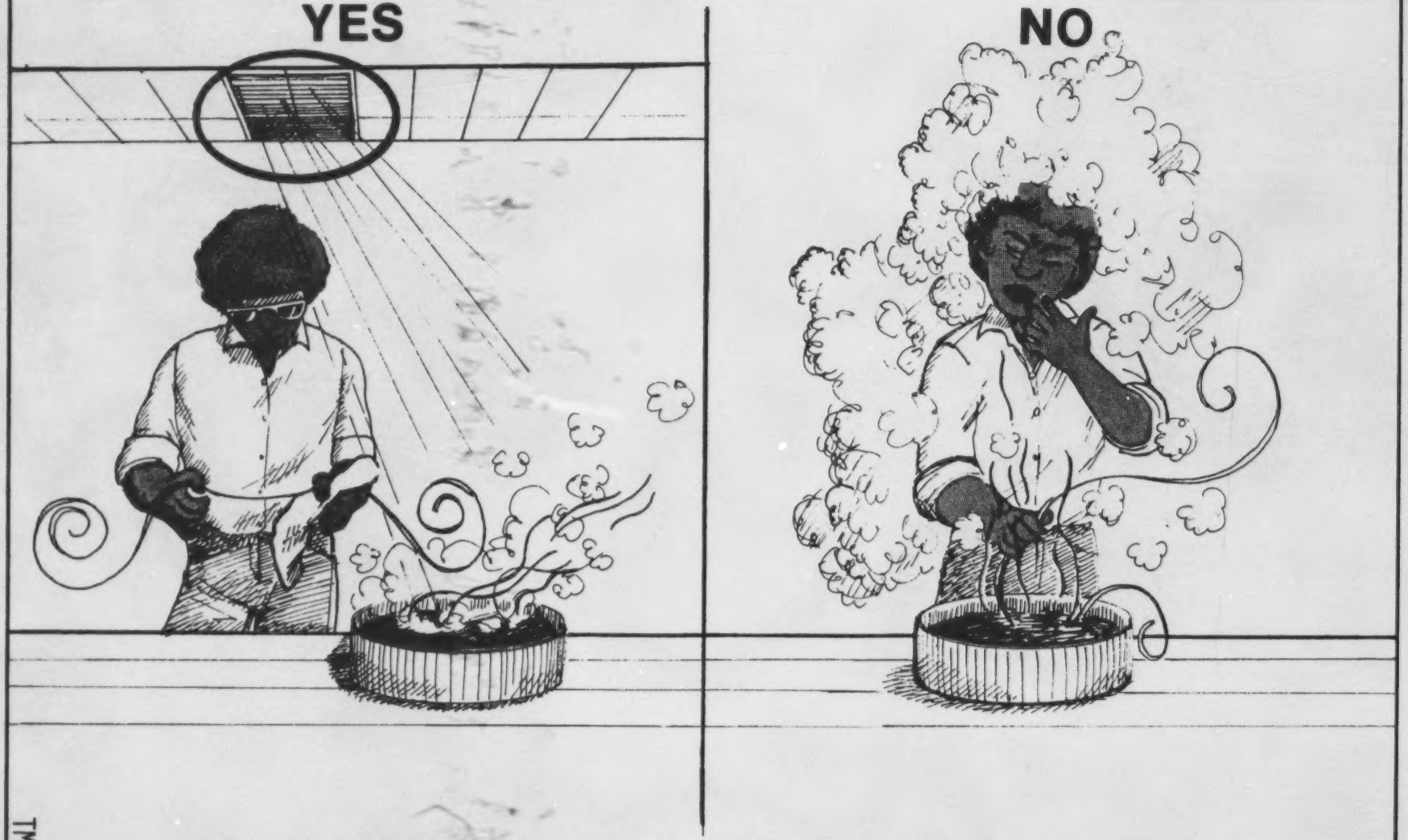
NO

TM-19

WEAR SAFETY GLASSES WHEN REPAIRING OR CLEANING THE REWIND SPRING

49

SAFETY TO FOLLOW

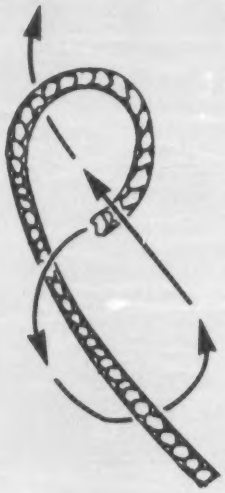


TM-20

WHEN USING CLEANING FLUID, OPEN A WINDOW OR TURN ON THE AIR IN THE SHOP.

TYING A FIGURE 8 KNOT

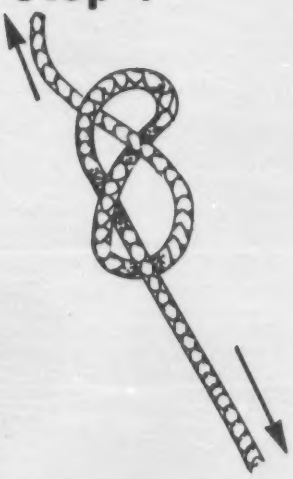
Step 1



Step 2

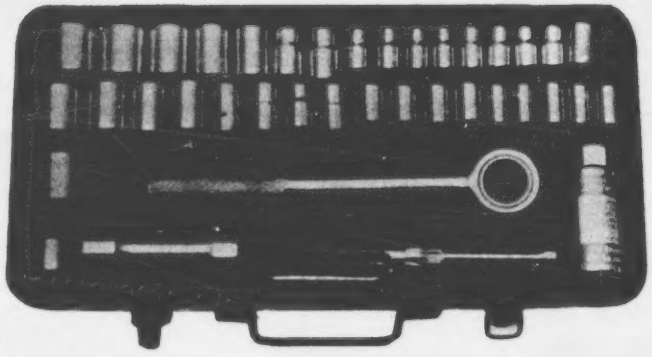
Step 3

Step 4

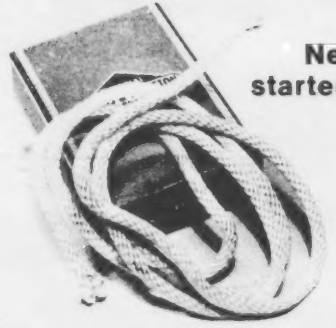


TM-21

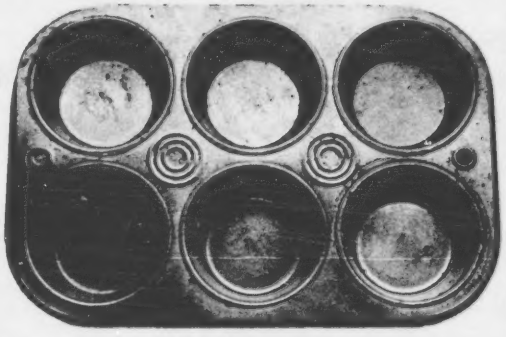
TOOLS FOR CHECK AND REPLACE THE STARTER REWIND ROPE



Socket set



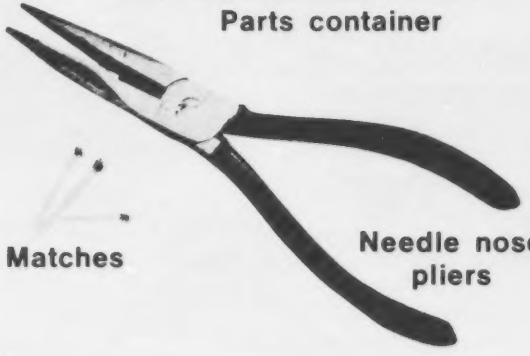
New starter rope



Parts container

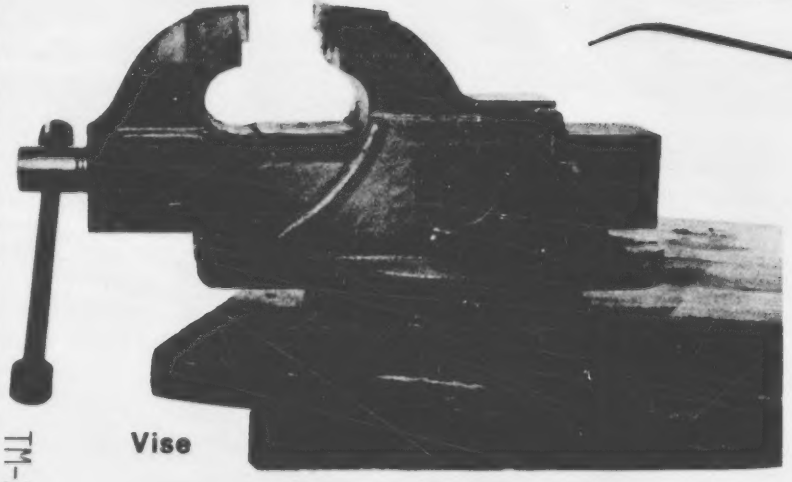
Diagonal cutting pliers

Oil can with oil

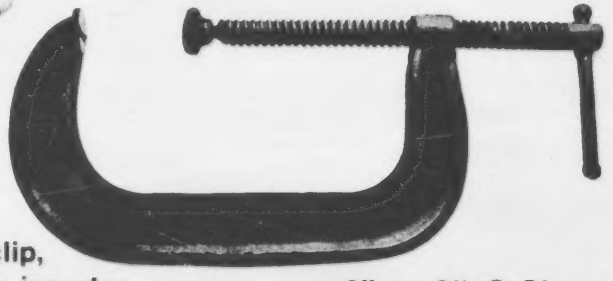


Matches

Needle nose pliers



Vise



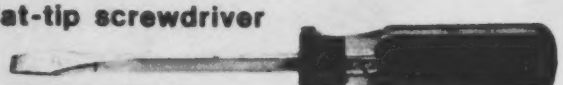
Thin wire, paper clip, or Briggs-Stratton rope inserter

6" or 8" C-Clamp

TM-22

55

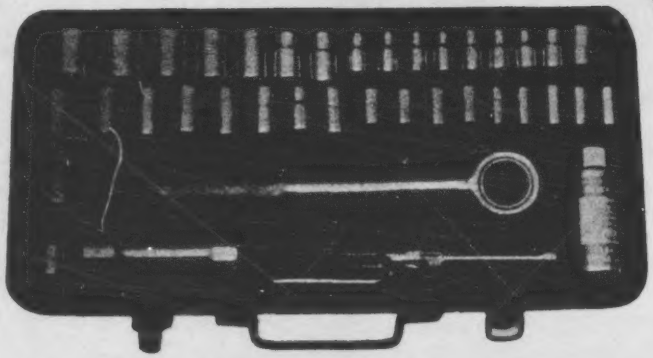
TOOLS FOR REPAIR THE STARTER REWIND SPRING



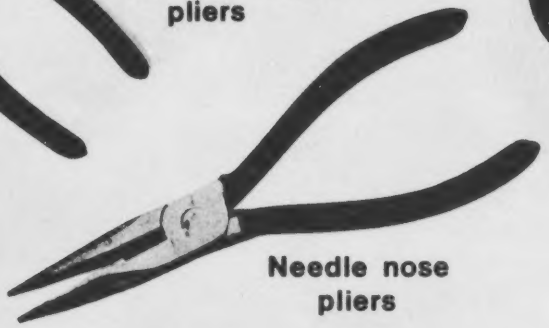
Flat-tip screwdriver

Safety glasses

Diagonal cutting pliers

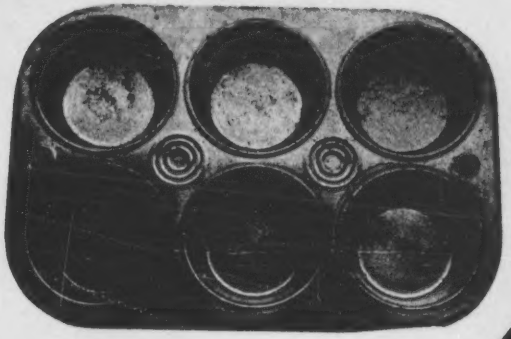


Socket set



Needle nose pliers

Matches



Parts container

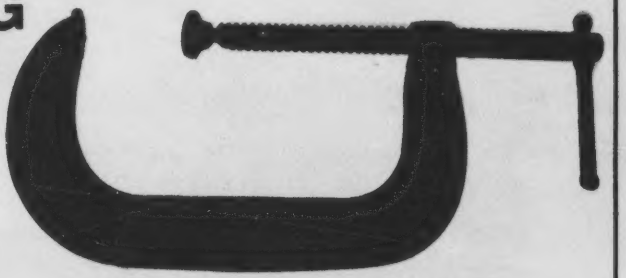
New rewind spring

Thin wire, paper clip, or Briggs-Stratton rope inserter

TM-23

TOOLS FOR REPAIR THE STARTER REWIND SPRING (CONT.)

New bumpers for tangs



6" or 8" C-Clamp

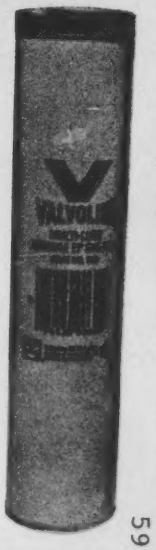
3/4" square wood stick
or 3/4" square metal bar with a T-Handle

Cleaning fluid

Container for
cleaning fluid

Vise

2 or 3 shop towels



Multi-purpose
grease

TM-24

59

ANSWERS TO REVIEW MATERIAL IN THINGS FOR YOU TO KNOW

Page 4, Purpose of the STARTING SYSTEM: How Much Do You Remember?

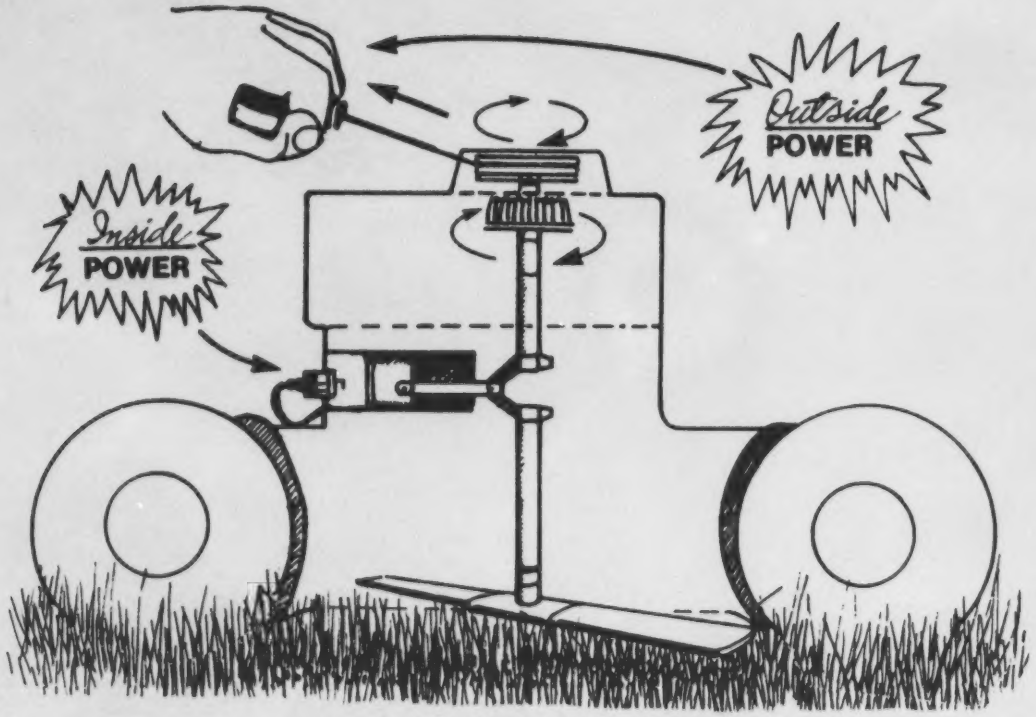
A. 1.

2.

3.

4.

B.



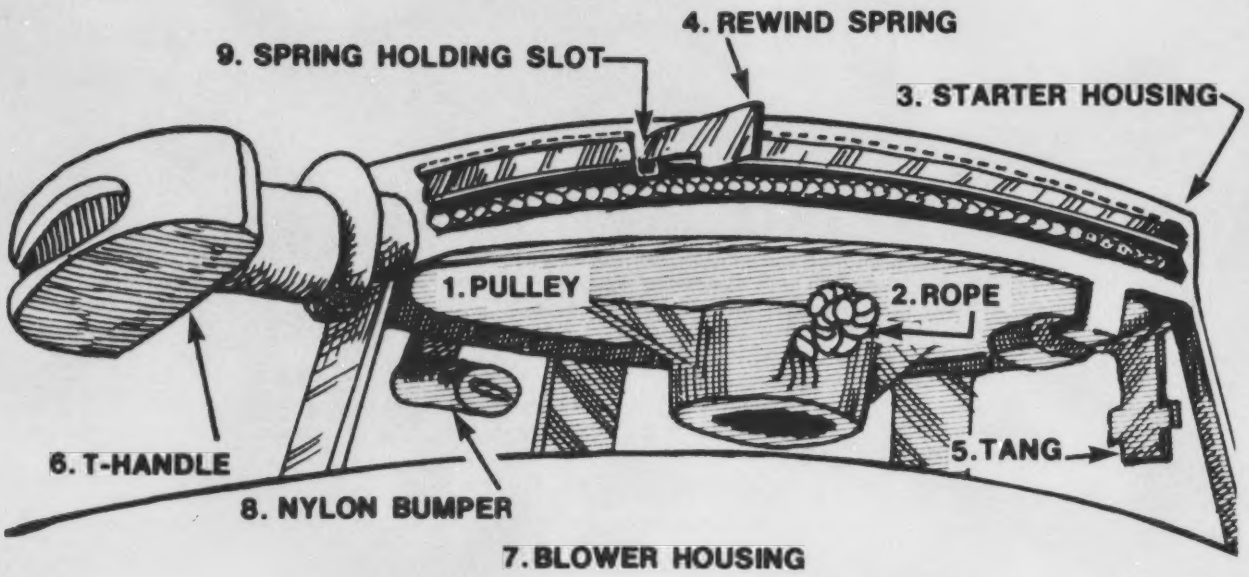
Page 10, The 4 Types of Small Gas Engine Starters: How Much Do You Remember?

A. 1. Rope rewind
2. Electric
3. Wind up
4. Rope wind

B. 1. a.
2. b.
3. a.
4. b.

Page 16, Parts of the Rope Rewind Starter: How Much Do You Remember?

A.



B. Across

2. Blower
4. Spring holding
5. Starter

Down

1. Rewind
2. Bumper
3. Pulley
6. Tang
7. Rope
8. T-handle

Page 21, How the Rope Rewind Starter Starts the Engine: How Much Do You Remember?

1. crankshaft, flywheel
2. piston, fuel, ignites
3. power, down, started, own

Page 35, Safety To Follow: How Much Do You Remember?

1-10. Evaluated to the satisfaction of the instructor. Students should be able to state in their own words the safety rule for each picture.

Page 42, Good Work Habits to Follow: How Much Do You Remember?

A.

1.	c	6.	a
2.	b	7.	c
3.	a	8.	b
4.	c	9.	b
5.	b	10.	a

B. Evaluated to the satisfaction of the instructor based on individual student's participation in the discussion.

EVALUATION MODEL

Evaluation charts are found in the student manuals after each of the sections on Things to Know, Safety and Good Work Habits to Follow, and the two repair jobs. These charts are to be used by the teacher as a motivational aid and the students as a self-evaluation of individual progress toward the objectives.

The evaluation charts are designed around an evaluation model that includes the three major areas for vocational competency. These three areas are:

1. Demonstration of knowledge
2. Performance of job skills
3. Demonstration of safety and good work habits

Please note that although each of these three areas are of equal importance for vocational competency, the teaching and evaluating of safety and good work habits to special needs students cannot be overemphasized. Vocational failure of most handicapped students is frequently due to their poor work habits and social skills.

It is recommended that evaluation of each student's knowledge, job skills, safety, and work habits begin after the student fully understands what is expected and some achievement toward the objective is beginning to show. Because of this the evaluation period will vary from student to student. Evaluation should last for a minimum period of two weeks or 10 consecutive school days. This length of time will allow most students to overlearn the objectives and thus achieve competency.

The rating scales for the evaluation charts are all similar. They are divided into 3 steps. Generally, these steps are:

RATING		MEANING
1	=	Does not reach the objective.
2	=	Reaches the objective, but needs help or needs to be reminded.
3	=	Reaches the objective without help. Ready for job entry with shop supervision.

Criterion for competency or the rating that a student must achieve for a predetermined length of time is suggested to be a rating of 3 on the evaluation charts for three consecutive days. For example, when a student is able to demonstrate knowledge about the starting system or perform safety, work habits, or starter rope rewind repair jobs without help for three consecutive days, then the student has reached criterion and is considered competent in that area.

STARTING SYSTEM: Check and Replace the Starter Rewind Rope

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
1	(FOCUS SLIDE)	(Music begins)
2	STARTING SYSTEM: Check and Replace the Starter Rewind Rope	STARTING SYSTEM: Check and Replace the Starter Rewind Rope. (Music fades out)
3	Lawnmower, mechanic--half of rope extended. Rope is frayed	A common problem with the starting system of small gasoline engines is that the starter rewind rope becomes frayed and cut, and then the engine will not start.
4	Starter rewind rope that is pulled out of the housing and badly frayed	As a small engine mechanic, you will need to know how to check and replace the starter rewind rope.
5	Group tool shot: socket set, needle nose pliers, diagonal cutting pliers, C-clamp, matches, parts container, new starter rope, thin wire or paper clip, oil can	Before you begin, gather all the tools you will need for this job.
6	Socket set in metal box, needle nose pliers, and oil can	You will need a socket set, needle nose pliers, lubricating oil, . . .
7	Vise	a vise, . . .
8	Diagonal cutting pliers, C-clamp, and parts container	diagonal cutting pliers, 6" C-clamp, and a parts container.
9	Matches, new starter rope, thin wire	You will also need a new nylon starter rope, matches, and a piece of thin wire or a paper clip.

67

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
10	Hand pulling off spark plug wire	Before beginning any work on an engine, always remove the spark plug wire . . .
11	Hand/spark plug socket removing spark plug. Arrow pointing to left	and spark plug. Always use a spark plug socket to remove the plug so that it is not damaged.
12	Hand pulling rope out with other hand braced on engine	To check the rope, first grasp the T-handle on the starter rope and brace your foot on the lawnmower.
13	Rope pulled all the way out of engine	Slowly pull the starter rope all the way out.
14	Frayed rope, arrow pointing to cuts and frays	Hold the rope out and see if it is badly worn. If it has cuts in it or is frayed, it will need to be replaced with a new nylon rope.
15	Hand holding T-handle, rope rewinding onto pulley, arrow pointing toward pulley	While holding the T-handle, slowly let the rope rewind onto the pulley. If the rope is let go too quickly the rewind spring may break.
16	Hand/nut driver loosening cable clamp bolt. Arrow pointing to left	To begin replacing the starter rope, remove the throttle cable. Use a 5/16" socket and nut driver to loosen the cable clamp bolt.
17	Socket/nut driver removing bolt on shroud. Arrow pointing to left	With a 7/16" socket and nut driver, remove the 3 bolts on the shroud.
18	Hand putting bolts in a parts container	Place the bolts in a parts container so they will not get lost or mixed up with other bolts.
19	Hand tightening vise around shroud	Lift off the shroud, turn it over, and place it in a vise. Be careful not to overtighten the vise or the shroud will bend out of shape.
20	C-clamp being placed inside shroud onto pulley	Place the C-clamp on the rewind pulley . . .

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
21	Bottom of C-clamp in place on blower housing	and on the bottom of the blower housing. Tighten the C-clamp just enough so that you will be able to pull out the rope from the pulley.
22	Hand holding out starter rope, other hand tightening the C-clamp	Slowly pull the starter rope all the way out and then tighten the C-clamp so that the pulley does not move. Let the rope hang loosely down the side of the shroud.
23	Pliers pulling out knot from pulley hole	Using needle nose pliers, pull the knot on the rope away from the pulley hole.
24	Cutting pliers cutting off knot	Cut off the knot with the diagonal cutting pliers . . .
25	Rope being pulled out of pulley	and pull the rope out of the pulley.
26	New rope	When replacing a starter rope with a new one, always use a nylon rope of the correct width and length.
27	Match burning both ends of rope	Using a match, burn both tip ends of the new rope until they melt slightly. Do not touch the melted rope ends because they may burn your fingers.
28	Arrows indicating a straight line to each hole	Before installing the rope, make sure the holes are lined up on the starter housing and pulley by turning the pulley to the left. This will make it easier to push the rope through the holes.
29	Paper clip hooked into one end of rope	Hook a piece of thin wire or a paper clip into one end of the rope. This will help push the rope through the housing and pulley holes.
30	Wire and rope being pushed through housing holes	Now, push the wire and rope through the housing and pulley holes.
31	Holes lined up. Needle nose pliers pulling rope and wire through pulley hole	With the needle nose pliers, pull the wire and rope through the 2 holes.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
32	Rope on inside of guide lug and through both holes	If there is a guide lug in the pulley, the rope should go on the inside of the lug.
33	Illustration of left-handed knot	Tie a left-handed knot near the end of the rope.
34	Needle nose pliers pushing knot down into pulley hole	Now, push the knot down into the pulley hole, using the needle nose pliers.
35	T-handle off rope, hand pulling pin out of knot	Remove the T-handle and pin from the old starter rope
36	Hand putting T-handle on rope	and put the T-handle on the end of the new rope.
37	Illustration of steps in making a Figure 8 knot	Using these steps, tie a figure-8 knot near the end of the rope. Do not pull the knot tight.
38	Pin in center of knot	Put the pin into the center of the knot and pull the knot tight.
39	Hand pulling T-handle over knot and pin	Pull the T-handle up over the knot and pin.
40	One hand holding starter rope and one hand removing C-clamp	Hold the starter rope near the starter housing hole and carefully loosen the C-clamp from the pulley.
41	Hand holding onto rope and letting it rewind into pulley	Slowly let the rope rewind into the pulley. Hold on to the rope so that it does not accidently fly up and hit you.
42	Hand pulling out rope	When the new rope is in the pulley, pull the rope out all the way to see if it has been replaced correctly.
43	Oil can squirting oil into hole on clutch	Now, lubricate the clutch by squirting 1 or 2 drops of oil into the hole on the clutch. Make sure that the starter clutch will turn freely on the crankshaft.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
44	One hand on shroud, other hand releasing vise	Remove the shroud from the vise and put the shroud back on the engine.
45	Shroud that is not fitted on-to clutch properly.	If the shroud does not fit tightly on the engine, then the clutch is not fitting into the pulley hub. Pull out the rope until the shroud slips into place.
46	7/16" socket and nut driver replacing a bolt. Arrow pointing to the right	Using the 7/16" socket and nut driver, replace the bolts that hold the shroud on the engine.
47	5/16" socket tightening cable clamp. Arrow pointing to the right	Replace and adjust the throttle cable, tighten the cable clamp bolt, . . .
48	Hand replacing spark plug. Arrow pointing to right	replace the spark plug, and tighten it with a spark plug socket.
49	Hand replacing spark plug wire	Replace the spark plug wire.
50	Hand pulling T-handle to start engine	Now, crank the engine again several times to be sure the rope has been installed correctly.
51	Mechanic picking up tools from work bench	When you have finished this job, clean your work area, return tools to the tool room, and put the old starter rope in the trash. (Music fades in)
52	Credit Slide	(Credits - Music ends)

71

STARTING SYSTEM: Repair the Starter Rewind Spring

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
1	(FOCUS SLIDE)	(Music begins)
2	STARTING SYSTEM: Repair the Starter Rewind Spring	STARTING SYSTEM: Repair the starter Rewind Spring. (Music fades out)
3	Lawnmower, mechanic with puzzled look on face because rope will not rewind.	A common problem with the starting system of some small gasoline engines is that the starter rewind spring will break, become jammed in the pulley or lose its tension, and the engine will not start.
4	Starter rewind spring in pulley.	As a small engine mechanic, you will need to know how to repair the starter rewind spring.
5	Group tool shot: socket set, needle nose pliers, diagonal cutting pliers, screwdriver, vise, cleaning fluid, grease, container for fluid, parts container, safety glasses, 3/4" sq. wood stick, C-clamp, adjustable wrench, thin wire, matches, new spring, new bumpers	Before you begin, gather all the tools you will need for this job.
6	Socket set, needle nose pliers, flat tip screwdriver	You will need a socket set, needle nose pliers, a flat tip screwdriver, . . .
7	Safety glasses, a shop towel, and diagonal cutting pliers	safety glasses, a shop towel, diagonal cutting pliers, . . .
8	Vise	and a vise.
9	Cleaning fluid, container for fluid, multi-purpose grease	You will need cleaning fluid, a container for the fluid, a tube of multi-purpose grease, . . .

73

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
10	Parts container, 3/4" sq. wood stick, adjustable wrench, C-clamp	a parts container for bolts, a 3/4" square wood stick, adjustable wrench, and a C-clamp.
11	Thin wire, matches	You will also need a piece of thin wire and matches to replace the rope in the pulley.
12	New spring, new bumpers	If the rewind spring is broken and the bumpers on the tangs are worn, you will want to replace them with a new rewind spring and nylon bumpers.
13	Mechanic putting on safety glasses	To begin this job, put on your safety glasses. Safety glasses will protect your eyes from the spring if it snaps or hits you in the face.
14	Hand pulling off spark plug wire	Pull off the spark plug wire, . . .
15	Hand/spark plug socket removing spark plug. Arrow pointing to left	and remove the spark plug from the engine. Always use a spark plug socket to remove the plug so that it is not damaged.
16	Rope that will not rewind into pulley	Now, check the starter rope. If the rope is hard to pull out or does not rewind, then the spring has lost its tension or is broken. It will need to be repaired.
17	Hand/nut driver loosening cable clamp bolt. Arrow pointing to left	To repair the spring, first remove the throttle cable. Use a 5/16" socket and nut driver to loosen the cable clamp bolt.
18	Hand/nut driver removing bolt on shroud. Arrow pointing to left	Remove the 3 bolts on the shroud with a 7/16" socket and nut driver.
19	Hand holding parts container, other hand placing bolts in one of the compartments	So that the bolts will not get lost or mixed up with other bolts, place them in a parts container.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
20	Shroud being securely placed in vise that is mounted to a work table	Lift off the shroud, turn it over, and place it in a vise. Do not overtighten the vise or the shroud will bend out of shape.
21	Needle nose pliers pulling knot away from pulley hole	Using needle nose pliers, pull the knot on the rope away from the pulley hole.
22	Cutting pliers cutting knot near pulley	Cut off the knot with the diagonal cutting pliers.
23	Hand pulling rope out of pulley	Slowly pull the rope out of the pulley.
24	Needle nose pliers unhooking spring from the starter housing	To remove the spring, use the needle nose pliers to unhook the spring hook from the starter housing.
25	Hands pulling last third of spring out of the housing	Using both hands, slowly pull the spring out of the housing as far as possible. Hold tightly onto the spring so it will not coil up and hit you.
26	One hand holding onto spring, rest of spring dangling down shroud. Screwdriver under one tang bending it up	While holding the spring out with one hand, bend up 1 bumper tang on the housing with a screwdriver.
27	Hand lifting pulley out of housing	Carefully lift the pulley out of the housing. Keep the spring unwound and out of the pulley so that it does not coil up and hit you.
28	One hand holding pulley, other hand unhooking spring on hub	While holding out the spring, unhook it from the hub of the pulley. Set the pulley aside.
29	New spring in packaging	If the spring is broken, you will want to replace it with a new spring.

75

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
30	Shop towel in one hand, dipping spring in cleaning fluid that is in a container, other hand holding onto spring	If the old spring has lost its tension, but can still be used, then you will want to service it. With a shop towel, wash the spring in cleaning fluid to remove all the dirt and grease.
31	Left hand holding the coiled end of spring. Other end is stretched out (not in photo)	Straightening the spring will give the spring more tension to rewind the rope onto the pulley. To do this, hold the coiled end of the spring in your left hand . . .
32	Right hand at end of spring holding it between thumb and fingers	and in your right hand, grasp the spring between your thumbs on the outside curve of the spring. Pull the spring through with your right hand.
33	Thumb bending back first part of spring	As you pull the spring through, straighten it against your thumb by slightly bending back the spring. When all of the spring is straightened and doesn't coil up so tightly, then set it aside.
34	Shop towel wiping parts of housing	With a clean shop towel, wipe the other parts of the starter housing. If the nylon bumpers on the tangs are worn, replace them with new ones.
35	Pulley near starter housing. Spring hook near hole on pulley hub	To replace the spring, hold the pulley near the starter housing. Put the string hook through the hole on the housing and then into the hole on the pulley hub.
36	Pulley placed in starter housing, screwdriver bending down bumper tang	Set the pulley into the starter housing and bend down the bumper tang.
37	C-clamp being placed inside shroud onto pulley	Place the C-clamp on one side of the pulley . . .
38	Bottom of C-clamp in place on blower housing	and on the bottom of the blower housing. Tighten the clamp just enough so that you will be able to rewind the spring into the pulley.
39	End of stick placed in center of pulley hub	Place the 3/4" square stick into the center of the pulley hub. When the stick is turned, the pulley will wind up the spring.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
40	Hand tightening wrench onto stick	Fit the adjustable wrench securely onto the stick . . .
41	Wrench attached to stick. Wrench turning the stick and pulley. Arrow pointing to the left	and slowly turn it so the spring will wind onto the pulley. Continue winding the spring until it feels tight on the pulley.
42	Spring hook secure in starter housing hole	Check the spring hook to see if it is secure in the hole on the starter housing. You may want to hold the hook in place with needle nose pliers so that it doesn't come loose and go into the housing.
43	Stick turning to right (arrow pointing to right), holes lined up with dotted line running through both holes to indicate that they are lined up	Now, turn the stick back just enough so that the hole in the pulley and the hole in the starter housing for the rope are lined up.
44	One hand holding wrench, other hand tightening C-clamp	While holding the wrench, tighten the C-clamp . . .
45	Hand removing wrench and stick	and then remove the wrench and stick.
46	Thin wire pushing end of rope through hole on starter housing and through pulley hole	To replace the rope, hook a piece of thin wire through the rope and push the wire and rope through the holes on the housing and pulley.
47	Needle nose pliers pulling wire and rope up through pulley hole	Pull the wire and rope up through the holes using the needle nose pliers and then tie a knot at the end of the rope.
48	One hand holding rope, other hand loosening the C-clamp	Hold tightly onto the rope and carefully remove the C-clamp.

77

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
49	Hand lightly holding rope (arrow pointing to right) Rope being wound around pulley	Let the rope slowly rewind into the pulley.
50	Hand pulling out rope	Now, pull the rope out all the way to see if the rope and spring have been replaced correctly.
51	Finger placing dab of grease on top side of pulley	Place a small dab of grease on the top side of the pulley. This will lubricate the pulley when it rubs on the bumper tangs.
52	Hands untightening vise and removing shroud	Remove the shroud from the vise and put the shroud back on the engine
53	Shroud that is not fitted onto clutch properly. One hand on shroud, other hand pulling out rope	If the shroud does not fit tightly on the engine, then the clutch is not fitting into the pulley hub. Pull out the rope until the shroud slips into place.
54	Socket/nut driver replacing a bolt on shroud. Arrow pointing to right	Now, replace the 3 bolts which hold the shroud on the engine using the 7/16" socket and nut driver.
55	5/16" socket tightening cable clamp bolt. Arrow pointing to the right	Replace and adjust the throttle cable and tighten the cable clamp bolt, . . .
56	Hand/socket replacing spark plug. Arrow pointing to right	replace the spark plug, and tighten it with a spark plug socket.
57	Hand replacing spark plug wire	Replace the spark plug wire.
58	Mechanic cranking engine	Now, crank the engine several times to be sure that the starter and clutch work properly.
59	Mechanic picking up tools from work area	You are finished with this job when your work area is clean. Clean the tools and return them to the tool room. Place the broken spring in the trash, and put up the dirty shop towels. (Music fades in)
60	Credits	(Music ends)

REFERENCES

A. Briggs and Stratton Corporation. Service and Repair Instructions. Milwaukee, Wisconsin. 1979.

B. Hires, Bill et. al. Comprehensive Small Engine Repair. Oklahoma: Mid-America Vocational Curriculum Consortium, Inc. 1977.

C. Pipes, Ted. Small Gasoline Engines. Indianapolis, Indiana: Howard W. Sams and Company, Inc. 1973.

D. Turner, J. Howard. Small Engines: Care and Operation, Volume 1. Third Edition. Athens, Georgia: American Association for Vocational Instructional Materials. 1975.

E. Turner, J. Howard. Small Engines: Maintenance and Repair, Volume II. Third Edition. Athens, Georgia: American Association for Vocational Instructional Materials. 1974.